
ARIZONA 68
US 93
KINGMAN
REDWALL DRIVE
VALLEY PIONEERS WATER
BOLSA ROAD
BLACK MESA PIPELINE
COLORADO ROAD
UNKAR ROAD
ADOBE ROAD
MAVERICK ROAD
AZTEC ROAD
HOPI ROAD
BACOBI ROAD
BOSQUE ROAD
DAVIS DAM TO PRESCOTT 230 KV POWERLINE
GOLDEN VALLEY PLANNING AREA
SHINARUMP ROAD
DAVIS DAM TO PRESCOTT 230 KV POWERLINE EASEMENT
INTERIM WWTP SITE
RHODES HOMES GOLDEN VALLEY RANCH
HUALAPAI DRIVE
CHEMEHUEVI DRIVE
DESERT VIEW TRAIL
NORTHSTAR STEEL MILL (CLOSED)
WALNUT CREEK WATER
APACHE ROAD
SHOOTING RANGE
I-40
RHODES HOMES CONSTRUCTION FACILITY
AQUARIUS DRIVE
PERMANENT WWTP SITE
ASH DRIVE
SACRAMENTO ROAD
CENTENNIAL ROAD
OLD OATMAN HIGHWAY
TRANSWESTERN PIPELINE CO.
FOUR CORNERS PIPELINE CO.
QUARTZITE DRIVE
DAWSON DRIVE
NAVAJO DRIVE
YUMA ROAD
BURLINGTON NORTHERN AND SANTA FE RAILROAD
GRIFFITH POWER PLANT 600MW
NORTH
GRAPHIC SCALE
0 2000 4000 6000 FT
0 0.5 1 MILE
LEGEND
KINGMAN CITY LIMITS
GOLDEN VALLEY PLANNING AREA
VALLEY PIONEERS WATER SERVICE AREA
WALNUT CREEK WATER SERVICE AREA
RHODES HOMES ARIZONA
GOLDEN VALLEY RANCH
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FIGURE 1.1
LOCATION MAP
GOLDEN VALLEY RANCH INTERIM WWTP
V-1

Table 1.1 – Land Area

Township/Range	Sections
T21N, R18W	SW1/4, Section 34
T20N, R18W	Section 2, except SE1/4 of SE1/4
T20N, R18W	Section 3 with out parcels
T20N, R18W	Section 4 with out parcels
T20N, R18W	Section 8 with out parcels
T20N, R18W	Section 9
T20N, R18W	Section 10 with out parcels
T20N, R18W	Section 11 with out parcels
T20N, R18W	W1/2 and W1/2 of E1/2 of Section 14
T20N, R18W	Section 16

The majority of the Golden Valley site is vacant open space including a few livestock corrals and water tanks, foundations of old home sites and sporadic piles of building materials and debris. There are some minor uses including grazing, mobile homes and storage yards.

Adjacent properties are sparsely populated with mobile homes or completely undeveloped. To the east, in Section 14, is an Arizona Game & Fish shooting range. The "Old Oatman Highway" (US Highway 66) lies to the southeast, with Interstate Highway 40 being further to the south. Arizona State Route 68 is 5 miles to the north, with a connection to US Highway 93. Closer to Arizona State Route 68 is an area of denser development with one acre parcels. Although several communities have been mapped in the area, none have fully developed. The nearest, Sunrise Acres, lies 4 miles to the northwest, and consists of 1+ acre lots. The Bureau of Land Management (BLM) controls the majority of lands between this project and the City of Kingman.

1.3 Topography

Land slopes upwards towards the east and northeast toward the Cerbat Mountains, with a low elevation of approximately 2,410 feet along the west and southwest portion of the site to approximately 2,670 feet on the easterly edge of the site.

Drainage from the site is generally to the west and southwest towards the Sacramento Wash. The Holy Moses, Cerbat and Thirteen Mile Washes, as well as a number of unnamed washes, cross the site and discharge into the Sacramento Wash.

1.4 Geology

Based on USGS National Resource Conservation Service (NRCS) mapping for the area, the dominant soil type is the Bucklebar sandy loam. This is a deep to moderately deep, well to moderately well drained coarse grained soil with moderate hydraulic conductivity, and a typical depth to water table of 600' – 700' or more. These soils reportedly do not meet the requirements for hydric soil.

The site and surrounding area are underlain by Precambrian age metamorphic rocks, reportedly orthogenesis and paragneiss. Due to the considerable expanse of the site and variation in the topography from east to west, depth to bedrock would be expected to vary beneath the site. A geotechnical investigation has been performed and is included in Appendix A.

1.5 Climate

Kingman experiences a relatively hot and arid climate with the average daily high maximum of 95.6 degrees occurring during the month of July, and the average daily low minimum of 31.4 degrees occurring during the month of January. Kingman has an average annual precipitation of 10 inches, with the driest months in May and June. Occasional thunderstorms are common during July, August and September, while the winter months experience snow and rain.

1.6 Project Population Projections

The first phase of this development will consist of 800 single family homes with approximately half being active adult use. Typical density for a single family residence is three (3) persons per dwelling, and with an active adult dwelling, the density is 1.8 persons per dwelling. Based upon these densities and the distribution of the dwellings, the overall density will be 2.4 persons per dwelling, resulting in a projected population of 1,920 people.

1.7 Design Assumptions

1.7.1 Influent Flow Rate

Table 1.2 presents the methodology and assumptions used to create an influent flow rate for Phase 1 of Golden Valley Ranch.

Table 1.2 – Wastewater Generation Rate Assumptions

Dwelling Units	800 single-family dwellings
Average Wastewater Flow	100 gpcd
Average persons per dwelling unit	
Active Adult	1.8 persons
Single Family Residential	3.0 persons
Average density	2.4 persons
Flow Peaking Factors	
Peak Hour	2.2 per AAC R18-9-E301
Maximum Day	2.0
Maximum Month	1.2
Total Avg. Day of Max. Month Influent	240,000 gallons per day
Design Capacity	240,000 gallons per day

1.7.2 Influent Quality

Wastewater will be domestic from residences and commercial developments, with the majority of the flows being residential. Table 1.3 presents the assumed influent wastewater characteristics. Grease traps will be installed at some commercial connections to prevent oils, fats and greases from reaching the wastewater treatment plant.

Table 1.3 – Influent Wastewater Characteristic Assumptions

Influent pH	6.5 to 8.5
Alkalinity	unknown
Water temperature	10EC to 25EC
BOD5 (average)	250 mg/l
Total Suspended Solids (average)	250 mg/l
Total Kjeldahl Nitrogen (average)	40 mg/l

1.7.3 Effluent Quality

The treatment plant facilities will be designed to treat daily flows to a Class A+ effluent quality, as defined under Arizona Administrative Code Section R18-11-303. In addition, effluent will have BOD and TSS concentrations less than 30 mg/l, nitrogen concentrations less than 8 mg/l, and phosphorus concentrations less than 3 mg/l. Treated effluent will be used for irrigation of a proposed golf course. The golf course will be operational prior to development of housing, so treated effluent will be able to be pumped to the golf course upon plant startup. A secondary discharge to Thirteen Mile Wash is also planned; an AZPDES permit will be obtained for this discharge.

Section 2

Review of Treatment Alternatives

2.1 Discussion of Available Treatment Processes

There are several treatment processes that may be applicable for this plant. An overview of available treatment processes, with a common-sense "process of elimination" approach, followed by analysis of truly feasible alternatives, best serves the needs of the development. This analysis is presented herein.

For a 240,000 gpd interim WWTP phased to include two 80,000 gpd trains in Phase 1 and an additional 80,000 gpd train in Phase 2, the following treatment processes appear to be viable:

1. Conventional activated sludge biological treatment with denitrification.
2. Extended aeration biological treatment.
3. Biological treatment followed by membrane filtration.
4. Biological treatment with a fixed film media.
5. Sequencing batch reactor.
6. Physical/chemical treatment processes.

The basic working mechanism of most wastewater treatment systems is to use microbiology to our advantage. The processes use various methods to grow microbial colonies to remove detrimental components of the sewage. Combined with filtering and disinfection, these processes should achieve the development's goal of Class A+ effluent. Class A+ effluent is defined as follows:

1. After filtration, prior to disinfection:
   a. 24 hour average NTU measurement less than 2.
   b. No NTU measurement greater than 5 at any time.
2. After disinfection, prior to entry into reclaimed water distribution system:
   a. No fecal coliform in 4 of last 7 daily samples.
   b. No single sample greater than 23/100 ml.
   c. Five-sample total Nitrogen, measured as a geometric mean, less than 10 mg/l.

Conventional activated sludge (CAS) biological treatment with denitrification. The conventional activated sludge process uses treatment compartments with and without air to treat wastewater. Clarification basins allow treated wastewater to flow through the plant while holding the

microbes within the plant for recycle to the aeration basins or removal to the solids handling area. This process is a common method used in Arizona, but typically is not manufactured in relocatable modules. Because of its lack of relocatability, this alternative will not be considered further.

Extended aeration biological treatment. The extended aeration process is a broad category of processes that use air in various configurations to obtain treatment. These processes hold the wastewater for longer periods of time than a CAS process; hence, the generic name "extended air". Most processes in this treatment form have treatment areas with and without air, but use different means to develop these areas. Lagoons, oxidation ditches, and proprietary systems such as Biolac are just some of the extended aeration processes available. Upon inspection, lagoons and oxidation ditches do not meet the basic aesthetic requirements of the development and these will not be considered further. Certain proprietary systems such as Biolac may be applicable to the project, but typically these systems are not manufactured in relocatable modules. Because of its lack of relocatability, this alternative will not be considered further.

Biological treatment followed by membrane filtration. This process uses zones with and without air to treat wastewater, followed by membrane filtration. This process has gained much favor recently because membrane filtration is a positive barrier that prevents passage of particles, bacteria and viruses. Put simply, the membranes have a certain "pore size" and anything bigger than that simply cannot pass through the membrane and cannot be in the effluent. This system can minimize land area, but can be technically quite complex and maintenance intensive depending on the type of membrane system provided. These systems can be provided in relocatable modules. A typical process schematic is shown in Figure 2.1.

Biological treatment with a fixed film media. This technology uses various media to grow the microbes on a fixed surface instead of growing the microbes in suspension. The most popular media are trickling filters and rotating biological contactors. While the biological process is similar to CAS, increased maintenance of the fixed media and "sloughing" of the microbes (microbial growth clumps dropping off the fixed media and clogging the system) are two problems with this technology. In addition, this process does not provide denitrification, so additional treatment units are required. Finally, Arizona's hot, dry climate is not conducive to this type of treatment system. Therefore, this system will not be considered further.

Sequencing Batch Reactors (SBR). SBRs are a biological treatment process that combines the equalization, aeration and clarification processes in one basin. Wastewater enters the tank to a certain fill level; at this point, influent stops and the wastewater is aerated. Once treatment is complete, aeration stops, and the solids are allowed to settle. Finally, both liquid and solids are evacuated from the tank, and the process begins again. This saves significant land area, but process control is more difficult to maintain because the microbial growth rate must be adjusted every time the tank is refilled. These systems can be provided in relocatable modules, but appear to require significant labor effort to accomplish the relocation. A typical process schematic is shown in Figure 2.2.

Physical/Chemical Treatment Processes. These processes treat wastewater via a combination of chemicals and physical barriers. This technology can be employed when space is at a premium, but there are many drawbacks to this technology (very maintenance intensive plant, process

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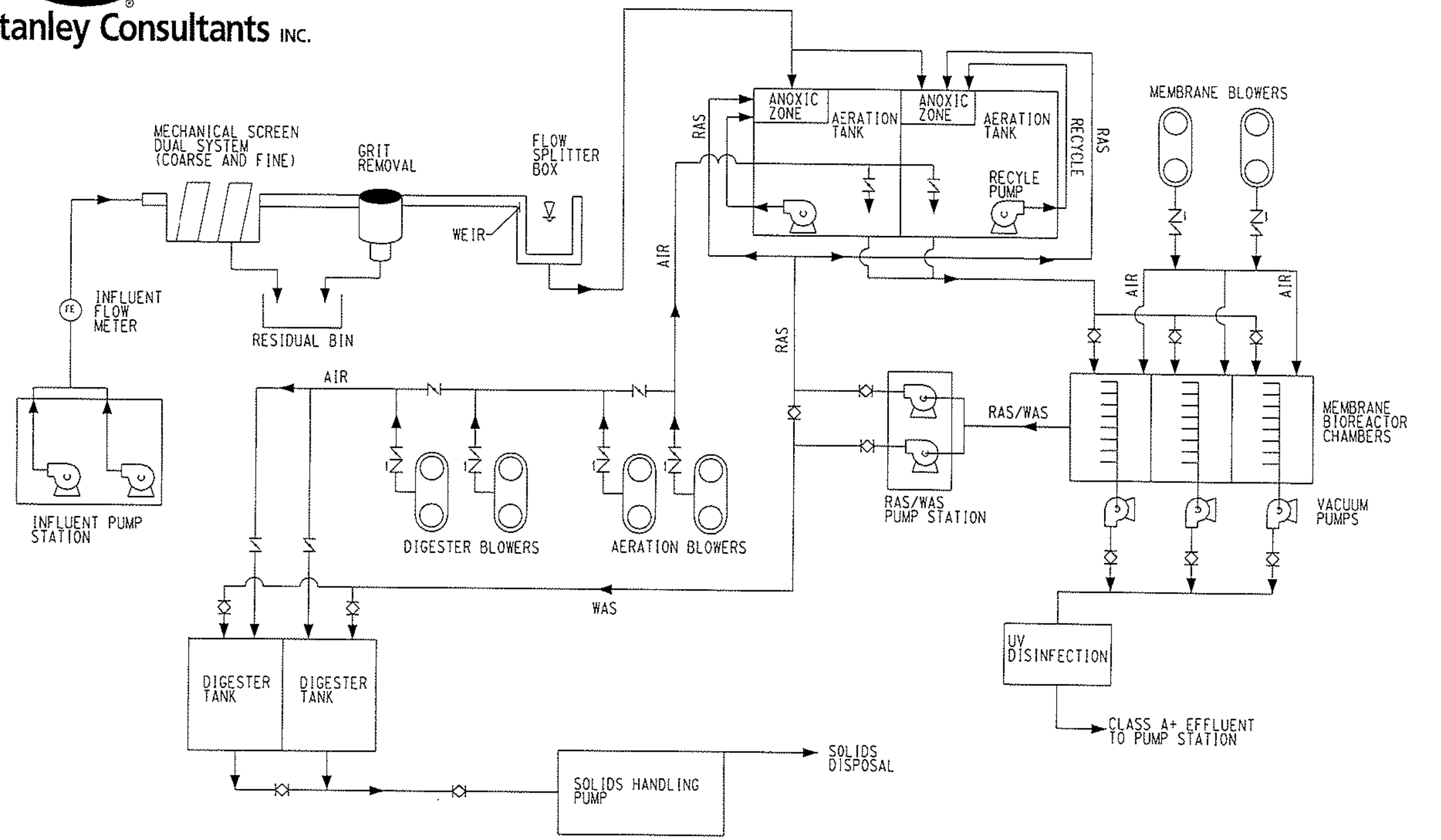

FIGURE 2.1

GOLDEN VALLEY RANCH
MEMBRANE BIOREACTOR TREATMENT
PROCESS FLOW DIAGRAM

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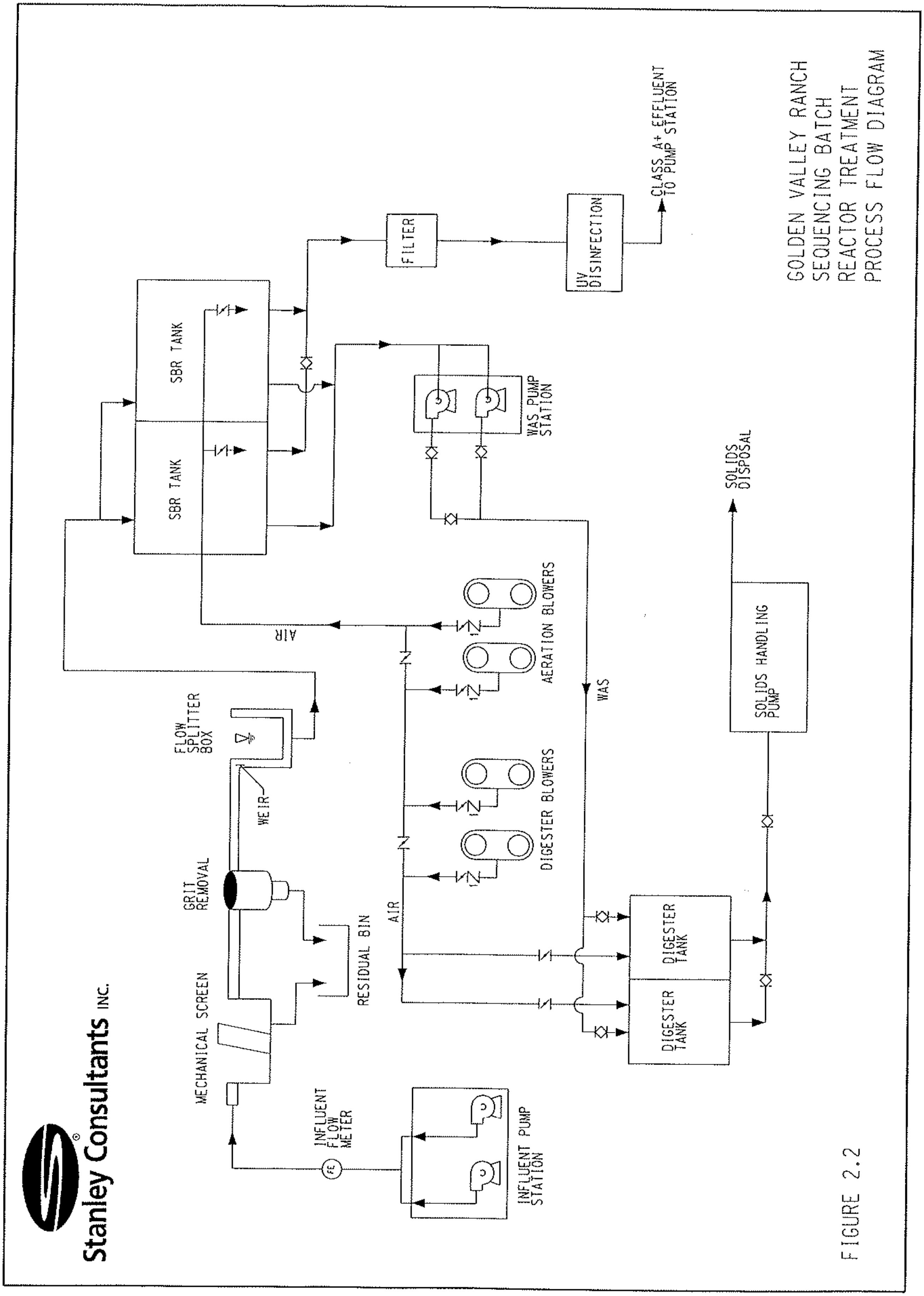

GOLDEN VALLEY RANCH SEQUENCING BATCH REACTOR TREATMENT PROCESS FLOW DIAGRAM

FIGURE 2.2

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control more difficult than biological processes, very high chemical cost, etc.) that make it infeasible for this development. It will not be considered further.

2.2 Selection of Treatment Processes for this Application

Most of the technologies listed above are feasible for the Golden Valley Ranch interim WWTP from a treatment perspective. In addition to pure treatment capability, the plant must also meet the following selection criteria:

1. Plant footprint must be minimized.
2. Equipment cost must be competitive.
3. Plant must be relocatable to serve other developments once the permanent WWTP is constructed.

When these factors are added to the evaluation, the following treatment processes fall out as feasible:

1. Membrane system.
2. SBR system.

Stanley Consultants will review these systems to determine which system is the "best fit" for Golden Valley Ranch.

Section 3

Review of WWTP System Components

3.1 Influent Pump Station

3.1.1 Structure

The initial receiving component of the treatment system is a low-head lift station designed to pump the influent from the gravity sewer collection system into the headworks. The lift station design will use either an interceptor manhole to divert the sewage out of the collection system and into a separate wet well, or be an integral part of the collection system, such as a collection system manhole with removable pumping equipment. In either case, the lift station will be an underground structure.

Depending on the site design constraints, the structure will range in size from five foot to eight foot diameter. The structure size depends on the desired depth range in the sump, maximum allowable residence time in the sump, and possible need for surge capacity upstream of the headworks. Structure materials will be either pre-cast or cast-in-place concrete, or a combination thereof.

The structure will be sized for passing of the peak hour flows expected for the WWTP.

3.1.2 Equipment

A typical lift station consists of pumps to move the wastewater to the headworks and level controls to operate the pumps automatically. Submersible pumps installed directly in the wetwell and "drywell" centrifugal pumps installed adjacent to the wetwell in a separate dry pit are common pump installations. Vertical turbine sewage pumps were considered, but their applications in raw sewage are very limited. The level controls indicate high and low water levels to start and stop the pumps, or control variable frequency drives (VFDs) if VFDs operate the pumps.

A multi-pump station operated by on-off controls may be considered instead of a duplex (2 pump), VFD-controlled installation, but will require a larger structure capable of holding 3 or more pumps. A low-flow pump will be required in addition to larger units sized in combination to pump the peak influent rate. A standby pump should be installed

as a backup for the system in case one of the others fails to start. A multi-pump station is often more complex and generally costs more to construct than a small duplex VFD-controlled station.

For this development, pump protection will be installed at the inlet of the pump station to prevent large construction debris from damaging or destroying the pumps. Pump protection will consist of a coarse bar screen, with manual or automatic removal of debris.

The pump sizing is dependent on hydraulic considerations; therefore, the pumps will be sized for passing of the peak hour flows expected for the WWTP buildout capacity of 240,000 gpd.

3.2 Headworks

3.2.1 Influent Flow Meter

Influent wastewater flow can be measured in several ways. Commonly used methods include open-channel Parshall flumes, magnetic flow meters and Doppler ultrasonic meters. A Parshall flume is often used in wastewater plants because of its reliability to accurately read low and intermittent flows, ease of maintenance, and economy of installation. Magnetic flow meters and Doppler ultrasonic flow meters offer advantages in interim applications such as this because they take up less space and still provide accurate measurement of pumped influent.

3.2.2 Screening

3.2.2.1 Materials to be Screened

Regardless of the selected treatment process, the influent wastewater will be screened for debris in the wastewater. Such debris will be from construction activities, household items that may get flushed into the sewage system, or typical wastewater solids such as fecal matter and feminine hygiene products. If not properly screened from the flow stream, these items can be a detriment to the sewage treatment process.

3.2.2.2 Screening Equipment

Even though this plant has a life expectancy of less than three years, protection of pumps and process equipment is still paramount. As such, the design approach is that of a permanent facility with respect to screening. The lift station section discusses the type of coarse screening for the influent pumps. For protection of the process equipment, several companies provide manual or automatic screens in various sizes to fit the project needs. Most are available with options to wash and/or compact the screenings prior to disposal. The collected trash will be placed in a garbage receptacle and sent to a landfill. Screen opening size will be dependent on the type of treatment process, but typically ranges from 2-3 mm for membranes to 1/8" in size for SBR technologies. Due to the small openings in these types of screens, automatic cleaning is typically provided.

The screening equipment sizing is solely dependent on hydraulic considerations; therefore, the screens will be sized for passing of the peak hour flows expected for

the WWTP. In addition, a manual bypass will be provided in case of failure of the mechanical system.

3.2.3 Grit Removal

Grit removal is a "common sense" equipment component in permanent WWTP installations. Grit accumulation in tanks can impact hydraulic and biological performance, and grit is invariably damaging to pumps over time. However, in interim facilities it is possible that a wastewater treatment train can withstand minor incursions of grit if the time period is short enough. SBRs are able to pass small amounts of grit through the treatment process without direct impact to the treatment process, if grit is picked up by the WAS sludge pumps. Membrane systems are most susceptible to grit if it stays in suspension, as the grit can damage the membranes. Typically, though, grit settles out during some point of the treatment process in membrane and SBR plants. However, it is noted that Class A+ wastewater needs to be essentially grit-free.

Typical grit removal facilities include either a vortex type system that separates the wastewater from the grit or a simple gravity well that forces the wastewater velocities to reduce to the point that grit settles out in the well. This well often times serves a dual function of flow equalization prior to the treatment process.

The grit removal equipment sizing is dependent on hydraulic considerations. Grit removal equipment will be sized for passing of the peak hour flows expected for the WWTP.

3.3 Equalization

An equalization basin is sometimes required to attenuate the amount of influent arriving at a treatment facility. The basin is a tank installed between the headworks and the treatment process that serves as a holding cell for excess flows, such that the treatment process is not overloaded. This basin often serves a dual function of grit removal as discussed above.

The equalization basin, if installed, is solely dependent on hydraulic considerations and will be sized for passing of the peak hour flows expected for the WWTP.

3.4 Treatment Processes

From the overview provided in Chapter 2, is has been determined that for this facility, the feasible treatment processes are membrane systems (membranes), and sequencing batch reactors (SBRs). The following discussion presents more detail on these systems.

3.4.1 Membrane System

The membrane treatment process is a biological treatment process that combines clarification and filtration in one basin. It has become the treatment process of choice in many applications because of the key advantages listed in the advantages section below. The basic elements of the process are: (1) aeration basins, and (2) clarification/filtration basin.

Aeration Basin. The aeration basins house the microorganisms (microbes) that treat the wastewater. The tanks include anoxic (minimal oxygen) and aerobic (more oxygen)

zones to grow the types of microbes that break down the detrimental nutrients in the wastewater and remove Biochemical Oxygen Demand (BOD), which is a key regulatory parameter. The process also includes pumps to move the colonies of microbes and their food from the aerobic zone to the anoxic zone in kind of a "recycling of the food supply" treatment process.

Clarification/Filtration Basin. Membrane processes combine the clarification and filtration process in one basin. The filter cartridges are installed inside the basin, and additional air is added to the basins. Solids within the basin cannot pass through the filter membranes, so they are eventually wasted or returned to the biological reaction tanks. The filter membranes are typically a proprietary material that creates a tremendous amount of surface area for water to pass through in a small space.

Advantages of Membranes:

1. Membrane treatment plants are economical concerning space requirements because clarification and filtration are provided in one tank.
2. Membranes offer a true physical barrier that prevents particles of certain sizes from passing through the filters. While this advantage is maximized for water systems (i.e. dangerous microbes cannot pass into the potable water system), filtration requirements for Class A+ effluent are stringent enough to make membranes an advantageous, reliable choice.
3. Advances in integrity testing of the membranes have made finding, isolating and fixing membrane problems relatively easy to do.

Disadvantages of Membranes:

1. The system can be a complex system to operate depending on membrane type, and it may be difficult to find well-trained operators.
2. Capital costs can be higher than SBR systems.

3.4.2 Sequencing Batch Reactors

Sequencing batch reactors are a common method of treating wastewater in systems that do not generate significant flows. The system contains two components: (1) reaction chamber and (2) filtration.

Reaction Chamber. The reaction chamber in an SBR is nothing more than a holding basin for sewage flow. The basin is sized to accept raw sewage for a timed period coinciding with the minimum amount of time for the microbes to treat the sewage when the system is at maximum capacity. Therefore, as the system starts up, the sewage stays in the tank longer, providing an opportunity to stabilize the microbe colony early in the process. The amount of sewage in the tank builds to a maximum height in the tank; at this point, the treated effluent is pumped out of the tank and some sludge is wasted, thus lowering the water level in the tank to a point that it can accept more raw sewage without completely destroying the microbe colony. Air is added to the process as the water level in the tank builds; at a certain level, the air is turned off, allowing the MLSS to settle to the bottom and the treated effluent to rise to the top so it can be pumped out. Turning the air off also assists in the denitrification of the treated sewage.

Filtration. To achieve Class A+ effluent, filtration must be added. The type of filtration can be cloth-type membranes, pressure filters or sand filters.

Advantages of SBRs:

1. Requires small footprint for construction of the biological treatment basin.
2. Modular design makes it easily expandable.
3. Relatively simplistic theory of operation makes it easy to operate, even for operators without much SBR experience.
4. Flows significantly less than the rated treatment capacity can be treated; i.e., has a great "turn-down" ratio.
5. Capital costs can be lower than membrane systems.

Disadvantages of SBRs:

1. Because all processes are held in one basin, operation requires good control methods for process parameters (i.e. tight range of water levels for sequencing of the process, when to start and stop air to prevent septic conditions from developing, sludge wasting rate, etc.) to make the process effective.
2. SBRs typically require more land area than membrane systems due to the filtration element.
3. Costs for relocation are anticipated to be greater than membrane plants due to physical disassembly and reassembly of tanks.

3.5 Disinfection

The effluent generated by the treatment process must be disinfected prior to discharge into the environment. There are several different types of systems, among them chlorine injection, ozone disinfection and ultraviolet light (UV) disinfection. For this report, only the major advantages and disadvantages of these three options will be discussed.

3.5.1 Chlorine

Chlorine has long been used as a disinfecting method, and its ability to destroy detrimental organisms is will documented. However, Class A+ effluent used for direct recharge requires that no residual chlorine remain in the water. As such, a chlorine disinfection system requires the additional step of dechlorination with other chemicals to achieve the A+ rating. Also, chlorine transport and storage is becoming a regulatory burden in terms of safety, containment and reporting requirements.

3.5.2 Ozone

Ozone may be generated on site or delivered to the site by truck and stored in high pressure containers. For an interim plant, the requirement for storage facilities is typically not a cost-effective option. Generating ozone on site requires equipment that uses large amounts of electricity and oxygen gas. As in the delivered-to-site method, storage and operational facilities are required for the machinery and oxygen gas.

3.5.3 Ultraviolet Light

UV systems are fast becoming an acceptable part of the treatment process due to the increasingly stringent regulations associated with the use of chlorine gas. An inline UV

system connects directly to the piping system, has a small footprint and requires minimal operator attention. The system is also able to treat a wide range of flow rates without a need for bypass piping.

3.6 Effluent Disposal

3.6.1 Effluent Storage (Wetwell)

Effluent from the filters can be stored in above ground or underground wetwells. Above ground wetwells may be a more cost-effective solution in the size range being considered for this project, and may be able to deliver the water to the golf course via gravity flow. Golf course irrigation design and layout has not advanced to the stage where a gravity flow decision can be finalized, but once the golf course design has advanced to this stage the flow pattern will be evaluated. Underground wetwells are more aesthetically pleasing and this may be a factor in the storage decision, but the interim nature of this facility is such that the relocatability of equipment and storage facilities must be reviewed.

The wetwell will be sized to handle one hour of Phase one demand (approximately 7,000 gallons) on the assumption that the plant will obtain an AZPDES permit. If the AZPDES permit is not obtained, storage requirements will increase to as much as five days of demand. Without an AZPDES permit, project cost would increase significantly.

3.6.2 Effluent Pump Station

If required, water would be pumped from the wetwell to the final effluent disposal point. With an above ground wetwell, centrifugal pumps are typically employed to move the water to the disposal point. With an underground wetwell, vertical turbine pumps are typically employed to move the water to the disposal point. All components of the reuse water would be identified as such, using "purple pipe" for underground pipe and identifying nameplates for above ground facilities. Such systems will require independent operation to avoid cross-contamination with potable water systems.

3.7 Solids Handling

3.7.1 Hauling of Liquid Sludge

Hauling of liquid sludge is a possibility in small, interim plants. The sludge would be pumped from the treatment unit directly to a transport truck, for delivery to a landfill. There is precedent in Mohave County; sludge is hauled from existing WWTPs in this manner. The transport location would have to be constructed such that any spillage from the transfer operation is contained and delivered back to the headworks of the WWTP.

3.7.2 Digesters / Thickened Sludge Production

Waste Activated Sludge (WAS) is a common component of biological treatment systems. How this sludge is removed from each system varies. Sludge can be directly drawn off of the bottom of treatment basins in SBRs and membrane systems, so no separate thickening basins are required. This may, at times, cause operational concern because the sludge may not be thickened enough to obtain the highest solids concentrations from the dewatering equipment, so this factor weighs in the decision making process. As this

facility will be designed based on performance specifications for the various equipment being supplied, the equipment manufacturers will have to provide systems that guarantee that the solids handling system works; thus, they will make independent decisions on the need for digesters or other solids thickening methods to guarantee that their system will work.

3.7.3 Solids Dewatering Equipment

There are three primary equipment types for solids dewatering equipment – belt filter presses, centrifuges, and plate and frame presses. Each style of press can be used in an interim WWTP application, and all three can be provided in relocatable systems that can be moved to different locations. Belt filter presses and centrifuges are the two technologies that have the majority of market share at this point in time, but the parameters of this project - small throughput of solids, batch processing of the WAS, and relocatability of the unit - allows for plate and frame presses to be considered.

3.8 Odor Control

3.8.1 Background

In general, all wastewater collection and treatment system produce foul-smelling gases such as hydrogen sulfide (H_2S), ammonia and mercaptans. The normal action and existence of microorganisms in wastewater is the source of these dissolved gases, and abrupt changes in momentum, temperature or pressure can cause the gases to be released from the wastewater. As H_2S is the design standard for today's odor control systems, the focus of this discussion will be H_2S.

H_2S is the odor causing compound most commonly associated with WWTPs and is the compound most easily designed for removal. In addition, while not necessarily a critical design component in an interim WWTP, it is noted that H_2S gas can corrode and destroy certain metals and most concrete if the gas concentration is excessive for an extended period of time. Pump station wet wells, headworks and screens are some of the leading sources of H_2S production.

The removal of H_2S gas from these facilities is accomplished by enclosing the air space where the odors are generated and scrubbing the air with an odor control device using either individual technologies or a combination of more than one technology. Available technologies include wet scrubber adsorption, dry chemical adsorption, biological media, activated carbon, and others.

The Arizona Administrative Code Title 18, Chapter 9, Article B201 requires that for a new treatment facility between 0.10 MGD and 0.50 MGD, a minimum setback of five hundred (500) feet shall be provided between any adjacent property line and the nearest component vent if no odor, noise or aesthetic controls are installed or utilized. The setback may be reduced to one hundred (100) feet if full controls are employed. See AAC R18-9-B201 for further information.

3.8.2 Available Technologies

3.8.2.1 Wet Scrubber

Air from the headspace in the odor-generating area is drawn by forced-air fan into a scrubber module that contains water and chemicals to neutralize the malodorous components in the air. After treatment, the air is then exhausted to the atmosphere. The most common type of unit uses sodium hydroxide (NaOH, or lye) and sodium hypochlorite (NaOCl, or bleach) in the process. These units require constant process monitoring by automatic controls, a source of make-up water and periodic chemical replenishment in the treatment units. They typically use on-site bulk chemical storage tanks sized so that they require refilling on a monthly basis.

3.8.2.2 Dry Scrubber

Depending on specific requirements and the amount of air to be scrubbed from each unit, these scrubbers operate with either forced-air induction or passively. Only the smallest units may be passive. The air flows though the scrubber and reacts by adsorption with a dry artificial media to remove the malodorous compounds and gasses. The media is engineered to react with the specific compounds found in the air, and has a limit as to how much it can effectively remove. When it is spent, it must be replaced. These units generally do not require any controls and are available in a variety of configurations, sizes and type of media. Media replacement is often done on an annual or biannual basis, often under a maintenance contract with the equipment supplier.

3.8.2.3 Biological Beds

As with dry scrubbers, forced-air and passive systems are available, though passive units are rarely used for plant operations. Instead of an artificial media, they use a moisture controlled environment and organic media to collect the odor causing compounds and rely on biological colony formation to reduce the gas compounds. Many types of bed material are used, from commercial compost to leaf litter to plastic structures designed to maximize the surface area for contact between the air and the colonies. The units require make-up water and temperature controls to optimize colony growth. Normal replacement of the bed material is done once every two to four years, depending on the size of the unit and the amount of air scrubbed.

3.8.2.4 Activated Carbon

In some cases, activated carbon is used to polish the air coming out of one of the above types of scrubbers. The units are occasionally used as stand-alone scrubbers, but are often not as economical for larger scale operations as other types.

3.9 Ancillary Design Elements

3.9.1 Enclosures

Enclosures may be provided for headworks and solids handling facilities if not provided by the equipment manufacturer, as these are the two locations where odor control is required. Enclosure design will comply with the community aesthetic, but will be cost-optimized for the interim facility and will be relocatable if possible.

3.9.2 Electrical, Instrumentation and Control (EIC) and Supervisory Control and Data Acquisition (SCADA).

WWTPs in the 21st century rely on computer control systems to operate and maintain peak performance. There are varying levels of computer control that are available for use at the plant, and oftentimes a balance must be struck between "using every bell and whistle available" and "not using enough computer control". In the case of an interim WWTP, it is clear that not every bell and whistle is required to operate the plant safely and efficiently. What is required is a basic operating system whereby the operator has access to the information needed to operate the plant and instantaneous notification (24 hours a day, 7 days a week) in the event of a problem at the plant. This can be achieved by use of a remote communications system. The primary remote communications systems are autodialers and SCADA communications systems. Autodialer systems provide primarily alarm functions, with limited ability to control plant functions. SCADA systems can be configured in a wide variety of ways; typically, they provide a central location for all plant data such that the plant can be controlled from this location. The location does not have to be at the plant site; it can be configured to be at the home of a remote operator, for example. Both systems work; in the case of an interim plant, operator preference and owner finances play pivotal roles in the decision of what system to use.

3.9.3 Site Piping and Site Work

Sewage treatment plants require pipe networks to route sewage and sludge flows through the plant. To reduce project cost and improve plant reliability, the main process train is designed to eliminate internal pump stations and maximize gravity flow. The site piping will be designed to simplify the 2-phase project as much as practically feasible.

Any site of this type will require earthwork. Excavation of unit process locations, such as the influent pump station, site grading to provide improved structural support to basins, site grading to improve aesthetic appearance, and surface toppings and features to provide dust control and improve aesthetic appearance are all required elements of construction at a sewage treatment plant. In addition, landscaping elements will improve the plant's aesthetic appeal. These design elements will be cost-optimized to balance aesthetic requirements against the interim nature of the plant.

3.9.4 Flood Protection

Wastewater treatment plants are typically designed to keep the treatment plant continuously operational during a 100-year flood event, as defined by the FEMA floodplain maps of the region. This is a requirement and is a sound business practice, even for an interim WWTP facility.

3.9.5 Backup Power

Arizona Administrative Code (AAC) and ADEQ regulations state that a sewage treatment plant must provide a backup power source to maintain operation in case of main power failure. For this WWTP, the backup power source can be a diesel fuel generator, a natural gas generator, or a second feed from the power provider. The diesel fuel generator can be easily self-contained on-site, using a standard integral fuel tank. The natural gas generator

requires that the community have a dedicated gas distribution system for the generator to be considered economical in the long term. A second feed is defined for this project as power coming from a completely separate substation, which may not be practical for this development.

3.9.6 Project Intangibles

Location of wastewater treatment facilities adjacent to residential and commercial areas will have an impact on the siting of the facilities. In accordance with the Arizona Administrative Code, the setbacks for a facility with no noise, odor or aesthetic controls is 500 feet, while the setback is reduced to 100 feet if controls are provided. The primary element of note for the interim WWTP is that the current plant location is greater than 500 feet from any Phase 1 development.

The plant footprint can affect the aesthetics of the treatment facility. The larger the footprint, the more noticeable the facility will be, thereby drawing attention to it. In addition, the larger the footprint, the more land will be required for the treatment facility. SBRs and membrane plants are the two most efficient land use treatment systems.

In addition to the footprint would be the expandability of the system. It is difficult to determine the rate of development of a residential community. The population associated with that development has a direct impact on the sizing of the treatment facility. An easily expandable facility would allow the treatment to occur on a more consistent basis and reduce capital costs. SBRs and membrane systems are easily expandable.

This WWTP will be interim. The ability to develop components that are easily dismantled and relocated to another site will require significant flexibility in the units, and allow the reuse of equipment, thereby reducing overall costs.

Although the WWTP will start out relatively small, it will require an operations staff. By selecting a treatment process with a relative ease of operation, there will be a larger pool of qualified people to staff the plant, and allow training for future operators.

Section 4

Selected WWTP System

The selected WWTP system is described herein. The WWTP site plan is shown in Figure 4.1.

4.1 Influent Pump Station

The influent pump station will be a duplex pump station with two submersible pumps, with the system controlled by level transducers in the wet well and an on/off sequencing program internal to the pump station controls package. Each pump will be capable of pumping all of the peak influent rate at buildout capacity of the plant, thus providing reliability and redundancy in the case that one pump may be out of service for any length of time.

From the population projections and project phasing, the required treatment capacity of the plant has been established at 240,000 gpd for average day (Table 1.2). The applicable design criteria are presented in Table 4.1 – Lift Station Design Criteria. Use of the rules promulgated in the Arizona Administrative Code, Title 18-9-E301 results in a design peak influent rate of approximately 440,000 gpd, or 305 gpm. This report and design shall use a conservative value of 320 gpm for one pump operational and the other standby.

VFDs shall be used to vary the pumping rate between a minimum of 50 to 60 gpm to accommodate low flows, to 320 gpm using one pump at full speed. A maximum rate greater than 320 gpm may be achieved using both pumps if greater-than-expected instantaneous flows occur at the station. Pump output manifolded through a single 6-inch ductile iron pipe force main will be provided to accommodate this flow characteristic.

The wet well will be a 6-ft diameter reinforced concrete pipe (RCP). This minimizes the construction cost and provides up to three (3) feet of operational depth if needed. A total depth range of five to five and one-half feet is available including high-high alarm and low-low levels. Please see Appendix B – Influent Lift Station for additional information, calculations and preliminary pump selection cut sheets. The listed pumps are capable of 317 gpm for one pump and up to 475 gpm using both simultaneously.

Table 4.1 – Lift Station Design Criteria

Number of Housing Units – Phase 1	800 single-family dwellings
Population Density	2.4 persons per dwelling, average
Total Population Served	1,920 people
Average Daily Wastewater Production	100 gallons per person
Peak Monthly Factor	1.2
Peak Hour Factor	2.20
Design Average Day Influent Rate	200,000 gallons per day (140 gpm)
Design Average Influent Rate (Peak Month)	240,000 gallons per day (167 gpm)
Design Peak Influent Rate (Peak Hour)	305 gpm
Design Lift (Head)	21 feet

The collection system will be designed for an interceptor manhole to divert the sewage from the collection system into the wetwell. The interceptor is designed to direct the sewage downstream when the station is no longer needed, and the pipe to the wet well will be permanently severed or filled with concrete. It is anticipated that the pumps and controls for the lift station can be relocated to other Rhodes developments as initial flow and head requirements will be similar at these other developments.

4.2 Headworks

4.2.1 Influent Flow Meter

The influent flow meter will be required to meet a performance specification as follows:

Flow Range	0 gpm to 500 gpm
Flow Accuracy	3%
Flow Characteristic	Intermittent
Relocatable	Movable intact to another facility

A magmeter will be provided for this facility. Piping from the lift station to the headwords will be laid out to maintain fluid in the pipe during no flow periods.

4.2.2 Screening Equipment

A two-inch coarse bar screen installed inside the wet well at the influent pipe will be used to protect the WWTP equipment from large rocks and debris, which often finds its way into a sewer system during construction of new subdivisions. In addition, a 2 – 3 mm fine screen will be installed in the WWTP headworks to protect the treatment process from wastewater solids such as rags, toilet paper, large floatable sewage solids, etc. See Appendix D – Cut Sheets for examples of fine screens and a design drawing of a bar screen installed in a wet well.

4.2.3 Grit Removal

Grit removal will be used for the interim WWTP due to the inordinately large amount of grit anticipated from construction activity. Any sand and grit that is removed prior to the

treatment process will be properly collected and disposed of in a landfill. Any grit that gets into the treatment process and is removed with the sludge may be disposed of as part of the sludge.

4.3 Equalization

Due to the interim nature of this installation and the topography available for installing the upstream gravity system, an equalization basin will not be provided. The gravity system will be relied upon to provide emergency storage capacity without negatively impacting the plant operation. The lift station, with VFD controls for the pumps, will be capable of pumping more influent than the plant design capacity. It is not expected that the gravity system will become surcharged due to a high-flow event.

4.4 Treatment Process

The treatment process and equipment will employ the membrane bioreactor concept. Any system installed must have the following capabilities:

1. Secondary Treatment
2. Filtration
3. Nitrogen Removal Treatment

In addition, the system must meet the performance criteria listed below.

Table 4.2 – Treatment Plant Design Criteria

Treatment Plant Design Capacity	240,000 gallons per day, Average day of max. month flow
Number of Treatment Train Modules	2, each capable of 80,000 gpd, with third train installed in Phase 2
Effluent Water Quality	A+
5-day BOD	< 30 mg/l for 30 day avg.
5-day BOD	< 45 mg/l for 7 day avg.
TSS	< 30 mg/l for 30 day avg.
TSS	< 45 mg/l for 7 day avg.
24-hr Average Turbidity, after filtration	2 NTU (maximum)
Maximum Turbidity, after filtration	5 NTU
Detectable Fecal Coliform, after disinfection	Zero (0) in at least 4 of 7 daily samples
Single Sample Maximum, after disinfection	Less than 23 fecal organisms per 100 ml
Total Nitrogen, 5-month rolling geometric mean	Less than 10 mg/l

Proposals for equipment will be evaluated on performance, ancillary upstream requirements (screens, grit removal, etc.) and projected operation and maintenance costs. Since this is a temporary facility, significant differences in purchase costs, lease costs, land use requirements or O&M may preclude using a given manufacturer.

4.5 Disinfection

An ultraviolet disinfection (UV) system will be incorporated into the plant outlet piping. This will satisfy the Class A+ requirement in a one-step process and help to minimize chemical transport and storage concerns. Several companies such as Ozonia and Aquionics offer installation-ready inline assemblies that are not open to the atmosphere, and offer a choice of perpendicular or longitudinal lamp orientation. Some designs incorporate flow-paced controls to optimize the amount of energy consumed depending on plant flow rate as well as options such as automatic cleaning mechanisms to wipe accumulated deposits from the lamp sleeves.

The UV system will be required to meet a performance specification as follows:

Installation Type	In-line as part of enclosed piping system
Lamp Characteristics	Medium pressure
Maintenance	Automatic lamp wipers
Flow Controls	Step-down for energy efficiency

Proposals for equipment will be evaluated on performance, capital cost, and projected operation and maintenance costs.

4.6 Effluent Disposal

The effluent from the Golden Valley Ranch WWTP is intended to be delivered to the golf course irrigation system. The hydraulic requirements of the golf course system are such that the WWTP can deliver the water via a gravity piping system; no pump station is required. A manual valve will be installed in the piping network in the event that the golf course does not want the water.

The Golden Valley Ranch WWTP will also apply for an AZPDES discharge permit, so that when the golf course system is unable to take flows from the WWTP the water can legally be discharged into a tributary of Thirteen Mile Wash. For this interim WWTP site, designing a secondary reuse point such as a spreading basin or injection well is not financially feasible. The water can be delivered to this discharge point via a gravity piping system. A manual valve, normally closed and locked, will be installed in the piping network to prevent accidental discharge to Thirteen Mile Wash.

4.7 Solids Handling

Solids from the Golden Valley Ranch WWTP will be transported via tanker truck to a landfill in Mohave County. The transfer location will be fully contained such that in the event of spillage during transfer the spillage is routed directly back to the WWTP headworks. All Mohave County stipulations currently in place for existing WWTPs that use this method for solids handling will be followed at Golden Valley Ranch.

4.8 Odor Control

There are currently no plans to install odor control equipment for the interim WWTP. The WWTP infrastructure is located outside of the 500' buffer required by ADEQ for service to Phase 1 properties, and Rhodes Homes currently owns all the property surrounding the WWTP. The site plan does show a place holder for odor control equipment, should it become necessary, but

the technologies involved and the time frame for plant operation in this area clearly indicate that odor control is not required at this time.

4.9 Ancillary Facilities

4.9.1 Enclosures

The influent pump station and headworks will be enclosed to prevent uncontrolled migration of odors. The sludge transfer station will not be fully enclosed, but will be contained to insure that any spillage does not migrate off-site. There will be no administration building or enclosure for this site, as there is no full-time operator presence. A maintenance shed will be supplied to provide a place for on-site storage of materials.

4.9.2 Electrical, Instrumentation and Control (EI&C) and Supervisory Control and Data Acquisition (SCADA).

The interim WWTP will be provided with an EI&C system that is designed to meet all federal, state and local codes for materials, equipment and installation procedures. SES and MCC components will be installed in free-standing enclosures, ventilated and cooled to meet the temperature requirements of the installed equipment. Conduits will be installed for buildout conditions; i.e., all future conduit, with spares, will be installed in Phase 1. Communications with the plant will be via an autodialer system that sends out alarm conditions to the emergency response operator. The communication will be two-way concerning critical system operation; i.e., the operator will have the ability to dictate on/off control of hydraulic elements of the system over the remote communication line. Communication method is anticipated to be via phone line.

4.9.3 Site Piping and Site Work

Site piping will be sized for buildout flows for any buried piping. Piping will be buried where possible to minimize potential safety hazards. Common system piping will be sized for buildout flow conditions.

Site work will include proper site grading to verify that stormwater can be retained on-site, excavations for piping, foundations for equipment, landscaping elements as required, site protection such as fences, gates and/or walls, site access/parking area, and dust control measures both during and after construction.

4.9.4. Flood Protection

The site will be designed to maintain unimpeded operations during the 100 year storm event. This includes drainage, setting of floor and equipment elevations, water tight enclosures where required, and other elements of flood protection design.

4.9.5 Backup Power

The WWTP will be provided with a diesel engine backup power source, sized to operate the buildout capacity of the facility. Sizing will be restricted to equivalent service duty horse power, with an additional safety factor of 25%; i.e., standby or redundant horsepower will not be

included in the calculations for generator sizing. The generator will be provided with a sound enclosure, muffler, and integral fuel tank. The fuel tank will be a "double containment" tank.

4.9.6 Chemicals

There is no anticipated use of chemicals for day to day operation of the WWTP. Startup procedures may dictate temporary use of chemicals to clean process elements or "seed" the biological process to start growing the microbe colony. In addition, periodic cleaning of the process system may require chemicals. It is anticipated that any chemical usage will be sporadic and that chemicals will be delivered to site in approved containers, used for the process, and removed upon completion of the task that requires chemical usage.

Section 5

Permitting

5.1 208 Plan Amendment for Mohave County

Golden Valley South's 208 Plan Amendment will be submitted to Mohave County (the County) for review and conformance to the County's existing Water Quality Management 208 Plan.

A pre-application meeting has been held between the applicant, the County and ADEQ that familiarized all parties with the proposed facility. During the meeting the County and ADEQ identified specific criteria that will need to be included in the 208 Plan Amendments. A schedule for the project was also discussed during the meeting.

A 208 Plan amendment has been prepared based on the information identified in the pre-application meeting, subsequent conversation with ADEQ and County staff, and the 208 Plan Checklist. The plan amendment includes demonstrating the need for the facility, population projections, basis of design, wastewater characteristics, effluent reuse/disposal, solids handling, financial stability of the applicant, and a public relations plan.

The 208 Plan Amendment will be submitted to the County for review, with copies also being delivered to ADEQ. ADEQ and the County will review the amendment and return a list of corrections or make a request for additional data. Once all deficiencies are corrected, the document will be resubmitted to the County and ADEQ for approval. Upon approval of the document by the County and ADEQ, the County will make arrangements to schedule a public hearing. Public notice must be published 45 days prior to the public hearing taking place. Amendments will also be made available to the public for review 30 days before the hearing.

After the public hearing, copies of the meeting agenda and public comments on the facility will be provided to the applicant to incorporate the documents as an appendix. Corrections to the document can also be made during this time frame. The final 208 Plan Amendment will then be reviewed for approval by the Director of ADEQ, the Governor, and the EPA, which can take up to six weeks. Approval letters will be sent to the applicant and the County with copies of the amendment made available to ADEQ.

5.2 Aquifer Protection Permit

5.2.1 Application Process

The first step of the permit process is to schedule a pre-application meeting between the Owner and Arizona Department of Environmental Quality (ADEQ). The purpose of the meeting is to familiarize ADEQ with the project and to identify all applicable statutes and regulations for the proposed facility, including determining the level of effort for a hydrogeologic study for the area in question. As an option, a proposal may be submitted outlining how the informational requirements identified during the pre-application meeting will be met. ADEQ's response to proposals is generally within two (2) days.

The APP form included in the guidance manual must be submitted to ADEQ along with the appropriate fee; the application will not be processed without the fee. Once submitted, a project officer is assigned and will be the primary contact throughout the permitting process. The project officer will review the application for completeness, and if deficiencies are identified in the application, those deficiencies must be corrected. The permitting process will not begin until all deficiencies identified are corrected. Review of the application for completeness is generally 30 days.

In addition to the application form the following attachments are pertinent to the approval:

- Location map
- Site plan
- 60% percent design plans and specifications (although exceptions have been made in the past)
- BADCT (Best Available Demonstrated Technology)
- Typical wastewater characteristics.

5.2.2 Technical Review

Once the application is considered complete, the project officer will distribute the application to the review team. The review team will examine the merits of the technical data presented to determine if they support the conclusions of the application. The technical review timeframe is 90 days. If problems or questions with the data are identified, ADEQ will notify the applicant to correct the problems. At the time of notification the 90 day review process is halted, and the permitting process will resume after all information is received. If all statutes and regulations are met, the project officer will notify the applicant of ADEQ's preliminary decision to issue a draft permit

5.2.3 Draft Permit/ Public Involvement

The draft permit will include discharge limitations, groundwater monitoring limits, alert levels, reporting requirements and compliance schedule. Public notices and other supporting documents are also prepared at this time.

ADEQ will publish its intent to issue or deny the permit in the newspaper with distribution in the area where the facility is located. ADEQ will accept written comments from the public concerning the draft permit for approximately 30 days following publication. Any individual can make a request for a hearing within this timeframe. If there is significant public interest

or issues that were not identified in the permitting process, ADEQ will hold public hearings in a city near the location of proposed facility to solicit further public comments on the draft permit.

ADEQ's director shall make the final decision to approve or deny the permit based on the information provided in the application and comments received from the public. During this comment period, action can be taken to correct situations or deficiencies that could lead to denial. Appeals can be made to the Water Quality Board of Appeals.

5.3 Arizona Permit Discharge Elimination System (AZPDES) Stormwater Permit

General Permit Overview

A General Permit must be obtained from ADEQ prior to the commencement of construction activity at the project site. The following plans and forms have been identified and will need to be completed in order to obtain the General Permit. This can be completed by the Engineer or by the Contractor, but it is recommended that the contractor be the applicant.

5.3.1 Storm Water Pollution Prevention Plan (SWPPP)

The SWPPP describes the measures and practices that will be implemented by the responsible individual identified in the plan. Permit coverage begins from initial commencement of construction activities until all construction activity ceases. One SWPPP will be prepared for the entire project site and must be kept on-site throughout the duration of the project. The SWPPP must be completed prior to submitting the NOI but does not need to be submitted to ADEQ unless the project area is within ¼ mile of identified "impaired or unique" waters.

5.3.2 Notice of Intent (NOI)

The NOI form is required to be submitted to ADEQ in order to be authorized for stormwater discharges under the General Permit. A completed NOI form must be submitted to ADEQ two (2) business days before the permit coverage is needed. There are no fees required for processing. ADEQ will send a letter to the applicant regarding authorization status within two (2) business days.

If the project area is within a ¼ mile of an identified "unique" or "impaired" water, the NOI could possible be delayed for up to 32 business days. It is recommended that the NOI be submitted early to avoid any possible delays.

5.3.3 Notice of Termination (NOT)

Submission of the NOT must be within 30 days after all soil disturbing activities are complete. Authorization to discharge terminates at midnight on the day a complete and accurate NOT is received by ADEQ.

5.4 Reuse Permit

5.4.1 Permit Application and Process

To apply for an individual reclaimed water permit (Reuse Permit), the applicant must schedule a pre-application meeting with ADEQ to clarify the requirements of the applications. For this project a Type 2 General Permit for direct reuse of Class A+ reclaimed water will be required.

In addition to the application the following must also be included in the submittal package:

- Legal description of the direct use site.
- Source of reclaimed water to be directly reused.
- Volume of reclaimed water to be directly reused on an annual basis
- Class of reclaimed water to be directly reused.
- Description of direct reuse activity
- Water Balance calculations if needed

Once the application is completed and all technical data gathered, it is submitted to ADEQ along with the appropriate permit fee. ADEQ will than review the application for completeness. Once deemed acceptable, the application undergoes a substantive review to determine its adequacy under the governing statutes.

Once approved, ADEQ will issue a copy of the draft permit to the applicant prior to submitting a public notice as required for public participation. ADEQ will publish a Notice of Preliminary Decision to issue or deny the individual permit in one or more newspapers of general circulation where the facility is located. During this period written public comment is accepted by ADEQ for a period of 30 days.

After the public notice, a public meeting may be held if there is a strong public interest or issues are brought to the attention of ADEQ that have not been previously considered.

ADEQ will issue or deny the permit based on all input. Should the application be denied, the applicant has the right to appeal the decision within 15 days after being notified.

5.4.2 Additional Reuse Application Requirements

An NOI must be submitted as part of the Type 2 General Permit for direct reuse of Class A+ reclaimed water. The NOI shall be filed with ADEQ 60 days prior to the date the proposed activity will start.

5.5 Effluent Disposal

5.5.1 Direct Reuse

For direct reuse applications, a Reclaimed Water Individual Permit is required for the facility in addition to the Aquifer Protection Permit. Assuming both permits are obtained, effluent from the above ground storage tank will be utilized for golf course irrigation, parks and appropriate landscaping. Effluent will be conveyed via a separate piping system and effluent pump station. Storage ponds will be provided throughout the golf course in order to

effectively supplement the above ground storage tank capacity and as required in ADEQ's Engineering Bulletin No. 11. Direct reuse of effluent requires Class A or A+ effluent.

5.5.2 Direct Discharge/AZPDES Permit

Occasionally it may be necessary to discharge effluent from the interim WWTP to Thirteen Mile Wash if significant rainfall occurs making irrigation unnecessary, and all ponds have reached their capacity. An Arizona Pollutant Discharge Elimination System (AZPDES) Permit must be in place for the facility prior to discharging activities. Direct discharge to the Sacramento Wash will assist in the effective management of the golf course irrigation system and utilization of the storage capacity of the ponds and the above ground storage tank during wet periods.

The AZPDES permit has been submitted to ADEQ at this time. It is anticipated that the process for approval of the permit will take 6-9 months, inclusive of public comment and agency review time, and that stipulations may be added to the permit, once issued. Considering the interim nature of this WWTP, and that Class A+ effluent is the target of the treatment system, it is anticipated that only some type of flow monitoring and verification that Class A+ discharge is being produced will be required.

5.5.3 Groundwater Recharge

An option to direct discharge is to recharge directly into the underlying aquifer by using some type of constructed device such as an injection well or percolation basin. For an interim WWTP, this alternative is not financially feasible.

Appendix A

Geotechnical Evaluation

GEOTECHNICAL EXPLORATION REPORT
Phase I (1500 ± acres) at Golden Valley Ranch
Located at SWC of Shinarump and Yuma Road
Mohave County, Arizona

September 12, 2005

American Soils Engineering, LLC
Project Number: 1060-GEO

Prepared for:

Rhodes Homes of Arizona
2215 Hualapai Mountain Road, Suite "H"
Kingman, Arizona 86401

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American Soils Engineering, LLC

Geotechnical Engineering
Special Inspection
Materials Testing Services

September 12, 2005
Project Number: 1060-GEO

Rhodes Homes of Arizona
2215 Hualapai Mountain Road, Suite "H"
Kingman, Arizona 86401

Attention: Mr. Kirk Brynjulson

Subject: **Geotechnical Exploration Report**
Phase I (1500 ± acres) at Golden Valley Ranch
Located at Southwest Corner of Shinarump and Yuma Road
Mohave County, Arizona

1.0 INTRODUCTION

This report presents the results of a geotechnical exploration for a proposed residential development. The project is located on the southwest corner of Shinarump and Yuma Road, Mohave County, Arizona. The purpose of this study was to evaluate the subsurface conditions at the site and to provide design geotechnical recommendations based on study findings. The approximate location of the site is shown on the Vicinity Map, Figure 1.

1.1 Project Description

At the time of our exploration program, the site was vacant. Irregularly shaped Phase I (1500 ± acres) subject site is approximately center of Golden Valley Ranch (5800 ± acres). The Golden Valley Ranch is generally surrounded by undeveloped streets and vacant land, generally bounded by Shinarump Road to the north, Yuma Road to the east, Aquarius Road to the South and Tombstone Trail to the west. It is our understanding that the proposed development will consist of one or two story residential structures of wood frame construction with slab-on grade floors, no basements are planned, and it is assumed that final grades will be at or near existing grades (± 5 feet).

1.2 Scope of Services

The scope of services was established to provide information and to develop geotechnical engineering recommendations are included:

- Exploration of subsurface soil conditions was conducted by backhoe, total 49 (forty-nine) tests pit (enclosed appendix "A") and obtaining samples of selected earth materials as the test pit were advanced.
- Laboratory testing was performed on selected samples to evaluate the chemical, physical and engineering properties of the subsurface soils (enclosed appendix "B").
- Engineering analysis was performed to evaluate site earthwork, building foundations, slabs-on-grade, retaining walls and pavement structural sections.
- Surface seismic measurements were performed to establish a shear wave velocity profile and calculated average shear wave velocity to 100 feet to support a recommendation for a Site Class per Table 1615.1.1 of the 2003 International Building Code 2003 (IBC). Test procedure, graphics and location of the test in the Appendix C.

This report was prepared to summarize our findings, present our conclusions and recommendations. Our recommendations are based on the assumption that the soil conditions are similar to those disclosed by the exploration. If differences are noted during construction, or if changes are made in site plan, loading, foundation type or elevation, we should be notified so that we can modify or supplement our recommendations if it is appropriate to do so.

2.0 SITE CONDITIONS

2.1 Exploration Program

Subsurface conditions were explored by using backhoe. Total 49 (forty-nine) exploratory test pits were advanced to the depth of 10 feet maximum within the subject site. Test pits were backfilled with excavated soil. Field studies were conducted on July 20 to 25, 2005 and August 29, 2005. Field mapping, logging of test pits, in-situ density testing, and obtaining selected samples for laboratory testing by representatives of American Soils Engineering, LLC. The approximate test pits locations are shown in Figure #2.

2.2 Existing Surface Conditions

A surface reconnaissance was performed during site exploration. The subject site consisted of an approximately 1500.0 ± acres irregular shaped parcel. The relatively level site was gently sloping topographically from north to south. At the time of our exploration program, the site was vacant and covered with light to heavy native vegetation. Small to large washes were present on the property, generally draining to the south.

2.3 Subsurface Conditions

The native and fill soils encountered in the test pits were typically medium dense to dense, sandy, silty gravel, with cobbles and rocks. Subsurface conditions are being explored by using backhoe. Logging of the excavations, and obtaining samples of representative material for laboratory testing conducted by representatives of American Soils Engineering, LLC.

2.4 Ground Water

Free ground water was not encountered in the test pits at the time of excavation to a depth of 10 feet the maximum depth explored. Fluctuations in the level of the ground water may occur due to variations in rainfall, underground drainage patterns, and others factors not evident at the time measurements were made.

3.0 GEOLOGY AND SEISMIC CONDITIONS

3.1 Geology

The site is located in the Sacramento Valley, Mohave County, Arizona a structural basin of late Mesozoic to Quaternary. The Basin and Range Province is characterized by numerous mountain ranges that rise from broad, plain-like valleys or basins. Valley deposits are of Tertiary and Quaternary age. Unconsolidated sediments derived from the surrounding mountains, the Cerbat Mountains to the northeast, Hualapai Mountains to the east, the Black Mountains to the west, and Mojave Mountains to the south. The alluvial and lacustrine sediments in the valley consist of clay and silt interspersed with fine sand to coarse gravel, rocks and calcareous cemented deposits. In general, the sediments grade increasingly finer with distance from the source area and with decreased elevation. Many basin-fill deposits are dissected by wide terrace-like features along major drainages. Unlike streams that emerge from mountain fronts onto piedmont slopes, these streams flow approximately parallel to mountain fronts in the valley. Valley centers consist of small to large washes. The largest wash is Sacramento Wash, which is partially cross in the western portion of the site flows north to south.

3.2 Local Faulting, Subsidence and Fissuring

No faults are known to transect the site area. Geologic map of Mohave County - Arizona prepared by Eldred D. Wilson and Richard T. Moore (1959) the nearest mapped fault is a tectonic fault and is located several miles to the east of the site.

3.3 Seismic Considerations

The surface seismic measurements were used to establish a shear wave velocity profile and calculated average shear wave velocity to 100 feet to support a recommendation for a Site Class per Table 1615.1.1 of the 2003 International Building Code (IBC) and tests results indicate Site Class "C". Test procedure, graphics and location of the test in the Appendix C.

4.0 RESULTS OF LABORATORY TESTING

Laboratory tests were performed on representative samples of the onsite earth materials in order to evaluate their physical and chemical characteristics. Plasticity Index (PI) and swell tests performed on the samples at depths ranging 0 to 10 feet below the existing surface. Test result indicates top 0 to 3 feet soil cross the site low to moderately expansive soil, and below 3 to 10 feet low expansive. Test results are presented in Appendix B.

5.0 CORROSION

To evaluate the corrosive potential of the subsurface soils at the subject site, five samples were submitted to *Atlas Chemical Testing Laboratories* to test the soils for sodium (Na), water soluble sulfate (SO4), and total available water soluble sulfate (Na2SO4). A copy of the results provided by the Atlas Chemical Testing Laboratories is enclosed in Appendix B. Test results tests are summarized below in Table 1.

Table-1 Results of Chemical Testing

Sample Location	Depth (feet)	Sodium (Na) (%)	Water Soluble Sulfate (SO_4) (%)	Total Available Water Soluble Sodium Sulfate (Na_2SO_4) (%)
B-40	2.0	0.01	0.03	0.02
B-42	2.0	0.01	0.01	0.01
B-44	5.0	0.01	0.01	0.01
B-46	2.0	0.01	0.11	0.01
B-49	5.0	0.01	0.04	0.04

Based on test laboratory test results presented above, the onsite soils have "negligible" sulfate exposure potential; however, onsite soils may be corrosive to metals. Protection to buried metal pipes or the use of nonmetallic pipe where permitted by local building codes should be considered. Therefore we recommend the use of sulfate resistant concrete type V Portland Cement or equivalent, and that concrete in contact with the on-site soil exhibit the characteristics specified in the 2003 International Building Code (IBC) Table 1904.3 for "negligible" sulfate exposure conditions must use Type V cement; have a minimum specified compressive strength of 2,500 psi.

6.0 CONCLUSIONS AND DEVELOPMENT CONSIDERATIONS

Based on our field exploration, laboratory testing, geologic and engineering analyses, it is our opinion that the subject site is suited for development from a geotechnical engineering viewpoint. The recommendations presented herein should be incorporated into the final design, and construction phases of development.

7.0 EARTHWORK BALANCE

The volume change when excavate native in-situ earth materials compacted to a minimum relative compaction of 90 percent or higher of the laboratory standard proctor. American Soils Engineering, LLC performed in-situ density test within upper ten (10) feet of the subject site to determine approximate percentage of shrinkage.

During excavation a representative of American Soils Engineering, LLC performed density test to determine degree of compaction of the native in-situ materials and collected samples for laboratory testing. The approximate locations of the test pits are shown on the Figure 1 (reduced scale plan of the site) and test results are Appendix D.

Based on our field testing, laboratory testing, and engineering analysis; it is our opinion that average shrinkage of upper 10 (ten) feet of the subject site is 8.5%. However, it could be varying 2% plus or minus. Our analysis based 90 percent relative compaction of the laboratory standard proctor.

8.0 EARTHWORK CONSTRUCTION

8.1 General

All grading operations should be performed in accordance with the 2003 International Building Code (IBC), and the requirements of Mohave County except where specifically superseded in this report. During earthwork construction all work should be observed and tested by a representative of American Soils Engineering, LLC (ASE). If any unusual or unexpected conditions are exposed in the field, they should be reviewed by American Soils Engineering, LLC and if necessary, modified and/or additional recommendations will be offered.

All applicable requirements of the Occupational Safety and Health Act, and the Construction Safety Act should be met. If contractor(s) have any questions regarding site conditions, site preparation, or recommendations in this report, they should contact a representative of American Soils Engineering, LLC (ASE).

8.2 Clearing and Site Preparation

Strip and remove existing vegetation, debris, uncontrolled fill, loose and disturbed natural soils, and other deleterious materials from an area extending at least 5 feet outside planned dimensions in structural areas and 2 feet outside planned dimensions in other improved areas. If unexpected fills or underground facilities are encountered during earth work, such features should be removed and the excavation thoroughly cleaned and backfilled.

All deep removal area should be observed and tested by American Soils Engineering, LLC (ASE) prior to fill placement. Exposed surfaces should be scarified, brought to at least optimum moisture content and compacted to a minimum relative compaction of 90 percent of the laboratory standard ASTM D-1557.

8.3 Excavation and Fill Placement

a) Cut & Shallow Fill Areas

Subsequent to completing the recommended clearing and ground preparation, cut and shallow fill areas should be over-excavated 18 inches below footing and exposed over-excavated areas should be scarified, watered, processed and compacted to minimum 90 percent of the laboratory standard ASTM D-1557 prior to fill placement. Onsite excavated or imported soils may be placed in relatively thin lifts (with a maximum lift thickness of 12 inches), cleaned of vegetation and debris, brought to above optimum moisture content and compacted to a minimum relative

compaction of 90 percent of the laboratory standard ASTM D-1557. Based on the geotechnical exploration of the site, hard to very hard native materials may be encountered in foundation areas and could be difficult to excavate footing and utility trenches.

b) Fill Areas

Subsequent to completing the recommended clearing and ground preparation, all deep fill (more than 30 inches fill) areas existing native grade should be 12 inches scarified, watered, processed and compacted prior to fill placement. Onsite excavated or imported soils may be placed in relatively thin lifts (with a maximum lift thickness of 12 inches), cleaned of vegetation and debris, brought to above optimum moisture content and compacted to a minimum relative compaction of 90 percent of the laboratory standard ASTM D-1557.

Oversized materials may be encountered onsite. No rock or similar irreducible material with a maximum dimension greater than 12 inches shall be buried or placed in fills within five feet, measured vertically, from the bottom of the footing or the lowest finished floor elevation, whichever is lower, within the building pad. Oversize materials are to be placed in such a way as to not be "nested".

c) Frequency of density testing:

Field density tests should be performed at a minimum rate of one test for every 800 cubic yards of fill material placed, or one for every two vertical feet of material placed, whichever is greater. However, a sufficient number of field density tests shall be performed to provide an opinion to the degree of compaction achieved.

d) Transitional lot:

Transitional lot which is partially cut and partially fill, to mitigate differential settlement which may occur on transitional lot, the cut side should be over-excavated and processed to a depth equal to 1 foot below the bottom of the footings or to the depth of the fill, which ever is less. On transitional lot with more than 5 feet of fill below footings, plans need to be reviewed by American Soils Engineering, LLC and site-specific recommendations will be provided.

e) Street, Parking and Curb & Gutters:

Subsequent to completing the recommended clearing and ground preparation, all street, parking and curb & gutters in cut and shallow fill (less than 18 inches fill) areas subgrade should be over-excavated 18 inches below from sub-grade, watered, processed and compacted prior to fill placement. In the fill areas (more than 18 inches fill) should be scarified, watered, processed

and compacted prior to fill placement. Onsite excavated or imported soils may be placed in relatively thin lifts (with a maximum lift thickness of 12 inches) content and density to a minimum relative compaction of 95 percent of the laboratory standard ASTM D-1557.

f) Concrete Flatwork:

Concrete flatwork sub-grade should be scarified 18 inches; moisture conditioned to above optimum moisture content and compacted to a minimum relative density of 95 percent of the laboratory standard ASTM D-1557.

8.4 Excavation Difficulty

The native soils encountered in the test pits were typically very dense, sandy, gravel, with abundant cobbles, boulders to gravelly sand with silt, cobbles, boulders encountered during our subsurface exploration of the site. Dependent upon the depth of removals, very dense gravel, with abundant cobbles and boulders deposits and may be encountered during excavation. Moderately hard to hard layer generally may be excavated with heavy earthwork equipment. The contractors should satisfy themselves the relative difficulty of excavation and the equipment needed to accomplish excavation.

8.5 Fill Placement with Imported Material

Material proposed for import to the site should be sampled by a representative of American Soils Engineering, LLC for laboratory testing prior to use at the site. Import materials should be of similar or better quality than the on-site materials for their intended purpose. Imported soils should conform to the following:

Gradation Requirements	
Sieve Size	Required Gradation
6”	100
3”	70-100
No. 4	35-100
No. 200	10-30 (max)
Swell Requirements (60 psf surcharge)	
Low expansive materials (swell less than 4.0 percent)	
Chemical Requirements	
Water Soluble Sulfate (SO_4) content less then 0.2 percent	
Soluble Requirements	
Less than 3.0 percent Soluble material	

Field density tests should be performed at a minimum rate of one test for every 800 cubic yards of fill material placed, or one for every two vertical feet of material placed, whichever is greater. However, a sufficient number of field density tests shall be performed to provide an opinion to the degree of compaction achieved.

8.6 Slope Stability

All slopes should be designed at gradients of 2 to 1 (Horizontal to Vertical) or flatter. All slopes should be constructed in accordance with the minimum requirements of Mohave County and the 2003 International Building Code (IBC).

8.7 Footing Trench Excavation

All footing trench excavations should be observed by a representative of American Soils Engineering's office prior to placing reinforcement. Footing trench spoil and/or excess soils generated from trench excavations used for structural fill zones should be compacted to a minimum relative density of 90 percent if not removed from the site.

8.8 Select Backfill Report

One sample for every one thousand (1000) linear feet two (2) samples minimum should be obtained from excavated trenches or stockpiles intended to be used for trench backfill above the pipe zone. Samples should be tested in the laboratory in accordance to specifications of Select Backfill Material or Trench Backfill Material. A recommendation/report should be prepared based on laboratory results. Bedding and pipe embedment materials to be used around underground utility pipes should be well graded sand or gravel conforming to the pipe manufacturer's recommendation and should be placed and compacted in accordance with project specifications, local requirements.

8.9 Utility Trench Backfill

Utility trench backfill with onsite or imported materials (approved as select backfill materials) should be brought to near optimum moisture content and then compacted. Minimum relative trench compaction density of the laboratory standard ASTM D-1557) should be as follows:

- From 1 foot above top of the pipe to bottom of trenches 90% percent compaction
- From 2 feet below surface to 1 foot above top of pipe 90% percent compaction
- From surface to two feet below surface 95% percent compaction

8.10 Surface Drainage

Positive surface water drainage gradients (2% minimum) should be provided adjacent to the structures to direct surface water away from foundations and slabs towards suitable discharge facilities. Surface water should not be allowed to pond and/or seep into the ground or adjacent to structures, slab-on-grade, or pavements. Pad drainage should be directed toward the street or other approved area. Roof runoff should be directed away from foundations and slabs-on-grade.

9 FOUNDATION RECOMMENDATIONS

Conventional Foundations

The engineering analysis performed and the recommendations offered below have been prepared using the following anticipated strip footing (exterior wall footings) loads of 4,000 psf and assuming the recommended earthwork is performed. The conventional foundation recommendations provided below are from a geotechnical engineering perspective and are not meant to supersede the design by the project's structural engineers.

Allowable bearing pressure of 3,000 psf, the minimum width and depth of footings should be 12 inches embedment below the top of the lowest adjacent of pad grade for low expansive (0 to 4 percent expansion under a 60 psf surcharge) conditions. The minimum width 12 inches and depth of footings should be 15 inches embedment below the top of the lowest adjacent of pad grade for moderately expansive expansive (0 to 4 percent expansion under a 60 psf surcharge) conditions (figure 3). Reinforcement for footings should be designed by the project's structural engineer.

All footings should be on at minimum 18 inches compacted fill or hard cemented materials and should be verified by a representative of American Soils Engineering, LLC prior to concrete placement. Increases are allowed for the bearing capacity of the footings at a rate of 500 pounds psf for each additional foot of width and 1000 pounds per square foot for each additional foot of depth into the recommended bearing material, up to a maximum outlined. If the allowable bearing value exceeds 4,000 psf, further review is required. A one-third increase may be applied for wind or seismic loads. We estimate that total post-construction differential movement should be less than 1-inch across the proposed buildings.

Due to the potential for damaging differential settlement, structure foundations should not bear on both cemented and uncemented soils. If both are present at the foundation base, the cemented soil should be overexcavated by a depth of 12 inches and replaced by structural fill, or the uncemented soils should be overexcavated to expose cemented soils. The foundation overexcavation may be backfilled with lean concrete or AB (aggregate base) material compacted to at least 90 percent of the maximum dry density as determined by ASTM D1557.

Foundation recommendations are based on results of laboratory testing of selected samples and the result of field exploration. Based on our laboratory testing, the soils onsite were low to moderately expansive material (based on 60 psf surcharge). If highly expansive materials encountered during grading, it should be reviewed by American Soils Engineering, modified and/or additional recommendations will be offered.

Based on laboratory test results presented above, the onsite soils have "negligible" sulfate exposure potential; however, onsite soils may be corrosive to metals. Protection to buried metal pipes or the use of nonmetallic pipe where permitted by local building codes should be considered. Therefore we recommend the use of sulfate resistant concrete type V Portland Cement or equivalent, and that concrete in contact with the on-site soil exhibit the characteristics specified in the 2003 International Building Code (IBC) Table 1904.3 for "negligible" sulfate exposure conditions must use Type V cement; have a minimum specified compressive strength of 2,500 psi.

10.0 MOISTURE PROTECTION CONSIDERATIONS

The purpose of these guidelines is to aid in producing a concrete mat of sufficient quality to allow successful installation of floor coverings and reduce the potential for floor covering failures due to moisture-related problems associated with mat foundation construction. These guidelines may be supplemented, as necessary, based on the specific project requirements.

- Top 12 inches of finish grade soil should be above optimum moisture content prior to concrete placement.

- Minimum two inches of moist sand or AB (aggregate base) should be placed directly below the concrete slab.

- Minimum 10-mil thick vapor barrier should be placed directly below the two inches sand or AB (aggregate base) layer.

- Minimum four inches AB (aggregate base) or material approved by American Soils Engineering, LLC, should be placed below the 10-mil thick vapor barrier (Visqueen).

The guidelines presented above are based on information obtained from various technical sources, including the American Concrete Institute (ACI), and are intended to present information that can be used to reduce potential long-term impacts from slab moisture infiltration. It should be noted, the application of these guidelines does not affect the geotechnical aspects of the foundation performance, nor does it affect the amount of cracking in the concrete.

11.0 RETAINING AND BLOCK WALLS

Block wall or retaining wall foundations (if required) should be designed as follows:

- Allowable bearing value of 3,000 pounds per square foot may be used for design of footings which maintain a minimum width of 12 inches and a minimum depth of at least 18 inches into the properly compacted fill 12 inches. A bearing value increase of 500 psf is allowed for each additional foot of width and 1,000 psf for each additional foot of depth into the recommended bearing material. If the allowable bearing value exceeds 4,000 psf, further review is required.

- Continuous footings should be reinforced with top and bottom steel.

- Passive Pressure can be calculated using an equivalent fluid pressure of 350 psf /ft.

- Lateral sliding resistance can be developed using a 0.35 coefficient of friction. The passive pressure and the frictional resistance of soils may be combined without reduction in determining total lateral resistance.

- For yielding walls, where no surcharge or sloping backfill exists and where the top of the walls are free to move at least 0.002 times the wall height, the minimum soil lateral pressure should be 30 psf per foot of depth retained. For smooth, rigid, nonyielding walls, the minimum soil lateral pressure should be 60 psf per foot of depth retained.

- For yielding walls the lateral pressure for seismic force can be determined by the equation: For level backfill, the minimum earthquake-induced force should be $6.0H^2$ (lbs/linear foot of wall). For a 2:1 (horizontal to vertical) sloped backfill, the minimum earthquake-induced force should be $7.2H^2$ (lbs/linear foot of wall). These forces can be assumed to act at a distance of 0.67H above the base of the wall, where "H" is the height of the retaining wall measured from the base of the footing (in feet).

- These loads do not include hydrostatic, building, traffic or other additional loads. Surcharge loads should be added to the pressure(s) above using a factor of 0.3.

11.1 Retaining walls Drainage

Adequate drainage may be provided by a subdrain system behind the walls. This system should consist of a 4-inch minimum diameter perforated pipe placed near the base of the wall (perforations placed downward). The pipe should be bedded and backfilled with ½-inch to ¾-inch crushed rock and enclosed in filter fabric, such as TCMirafi 140N or equivalent. The subdrain outlet should be connected to a free-draining outlet or sump.

As an alternative to a full-height gravel drain trench behind retaining structures, consideration may be given to utilizing a manufactured geosynthetic material for wall drainage, such as Miradrain, Geotech Drainage Panels, or Enkadrain drainage matting. The drainage panel should be connected to the perforated pipe at the base of the wall.

11.2 Retaining walls Backfill

Retaining wall backfill material should be native or imported low expansive material. Backfill placed behind the walls should be compacted in relatively thin lifts (with a maximum lift thickness of 12 inches) a minimum relative compaction of 90 percent of the laboratory standard ASTM D-1557 using light compaction equipment. If heavy compaction equipment is used, the walls should be temporarily braced.

12.0 PAVEMENT DESIGN

Asphalt Concrete & AB Material

Based on our experience on the nature of the soils encountered onsite, the onsite materials may have R-value 45 or more. The recommendation for pavement design is based on R-Value 45 for planning purposes only and should be verified based on sample collected from sub-grade and specific laboratory testing performed subsequent to rough grading of the site. Further recommendation will be provided based on laboratory test results of sub-grade materials and average daily traffic (ADT).

ROADWAY TYPE	PAVEMENT DESIGN THICKNESS		
	R-value	Minimum Asphalt Concrete (AC) (inches)	Minimum Aggregate Base (AB) (inches)
Residential Collector	45	2.0	6.0
Minor Collector	45	3.0	8.0
Minor Arterial	45	5.0	10.0

Subsequent to completing the recommended grading of streets and parking areas, all street and parking sub-grade should compacted to a minimum relative compaction of 95 percent for native sub-grade and 98-100 percent for AB based on the laboratory standard maximum dry density ASTM D-1557.

13.0 SURFACE DRAINAGE

Foundation soils should not be allowed to become saturated during or after construction. Utility lines should be properly installed and the backfill properly compacted to avoid possible sources for subsurface saturation. Positive drainage (2 percent minimum) away from the structures should be provided during construction and maintained throughout the life of the structures. Any roof drains should be directed away from the structures. Backfill against footings, exterior walls and in utility trenches should be properly compacted and free of all construction debris to reduce the possibility of moisture infiltration. If practical, planters, landscaping, and/or other surface features which could retain water should not be adjacent to the structures or pavements. If this is not practical, we recommend the following: Planters should be sealed, grades should drain away from the proposed structures at a 2 percent minimum slope and watering should be kept to a minimum.

14.0 LIMITATIONS

The recommendations presented in this report are based on results of field and laboratory explorations, combined with interpolation of subsurface conditions between test pits locations. The nature and extent of variations between test pits may not become evident until construction. If variations are then exposed, it will be necessary to re-evaluate the recommendations of the report. If changes in the nature, design, or location of the project are planned, the recommendations contained in this report shall not be considered valid unless the changes are reviewed and the recommendations of this report modified or verified in writing. This report is not intended for use as a bid document. Any person using this report for bidding or construction purposes should perform such independent investigation as he deems necessary to satisfy himself as to the surface and subsurface conditions to be encountered, and the procedures to be used in the performance of work on this project. If conditions are encountered during construction that appears to be different than indicated by this report, this office should be notified. Professional services for this project were performed using that degree of care and skill ordinarily exercised under similar circumstances by reputable geotechnical engineers practicing in this or similar localities. No warranties, expressed or implied, are intended or made.

The opportunity to be of service is greatly appreciated. If you have any questions concerning this report or if we may be of further assistance, please do not hesitate to contact the undersigned.

Respectfully submitted,

American Soils Engineering, LLC

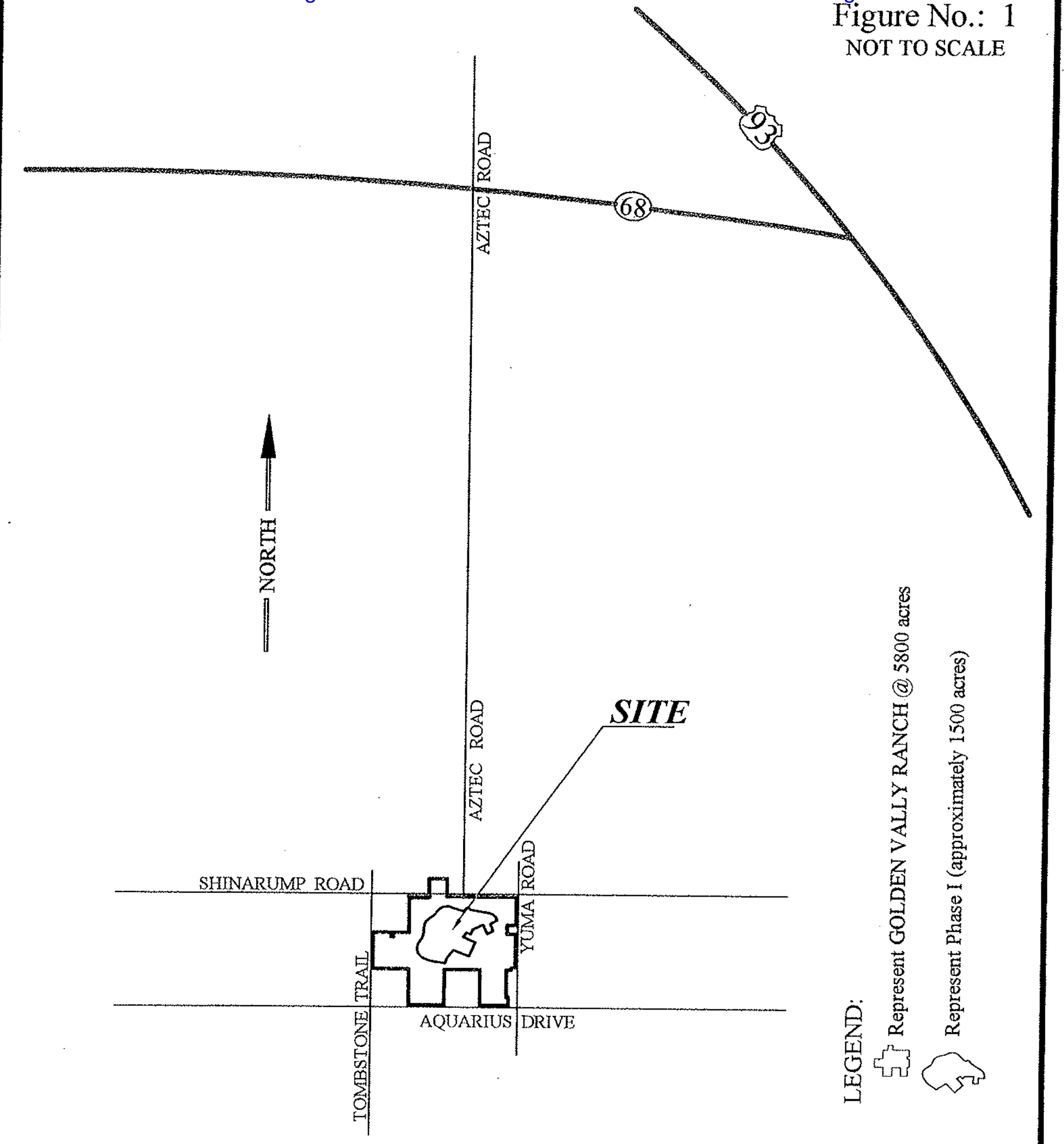
By:

Qamruzzaman Babul, PE
Principal Engineer

Registered Professional Engineer (Civil)
CERTIFICATE NO.
41691
QAMRUZZAMAN
BABUL
Date Signed 9/12/05
ARIZONA, U.S.A.

Babul

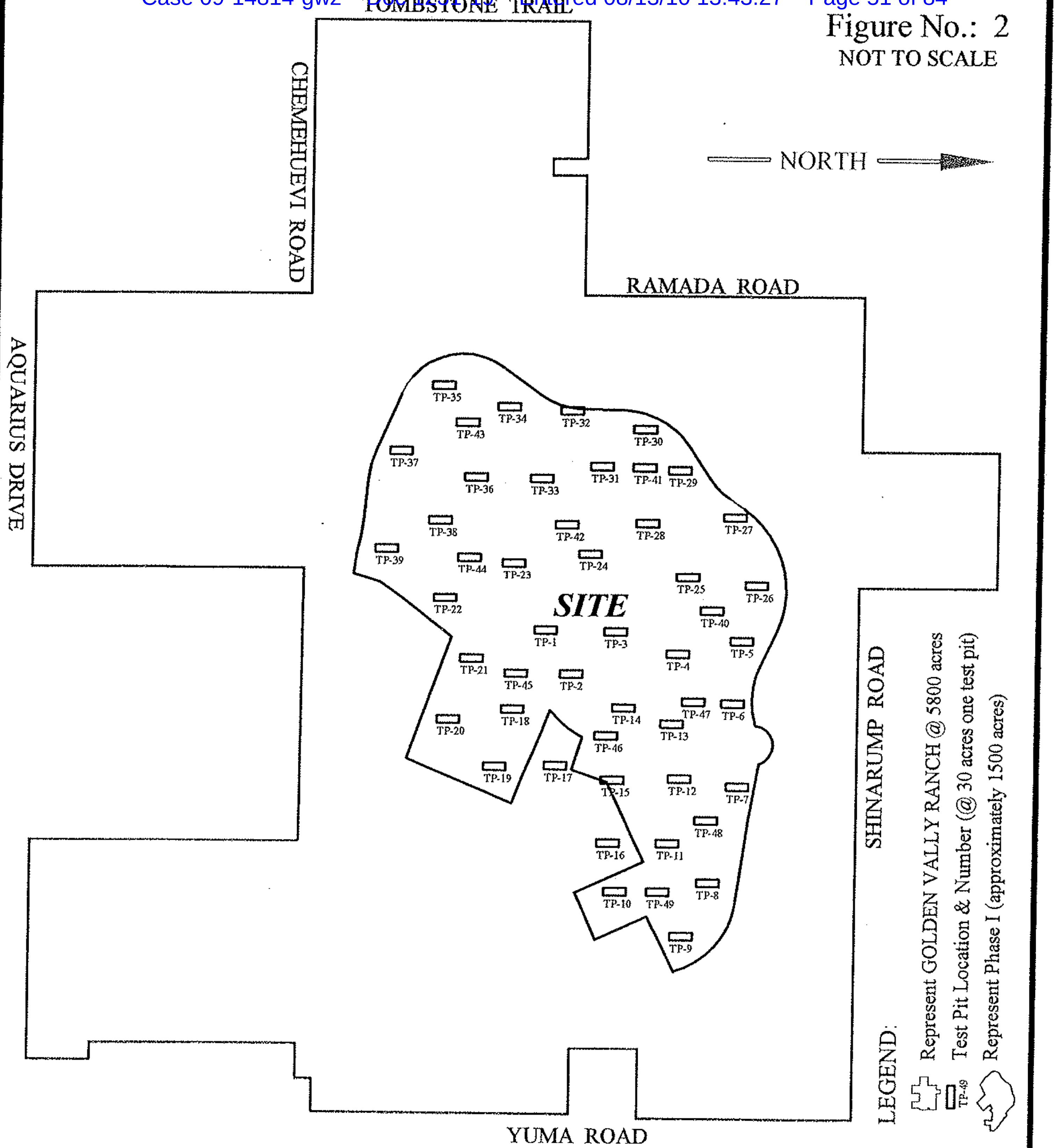
Figure No.: 1
NOT TO SCALE



American Soils Engineering, LLC
6000 S. Eastern Avenue, Suite 12E
Las Vegas, Nevada 89119
Phone: (702) 889-9617
Fax: (702) 889-9614
Geotechnical Engineering • Special Inspection • Materials Testing Services

VICINITY MAP	Project Number: PN 1060-GEO
Project: Phase I of Golden Valley Ranch Kingman - Arizona	Date: 09-09-2005
Prepared for: Rhodes Homes of Arizona	Drawn By: QB

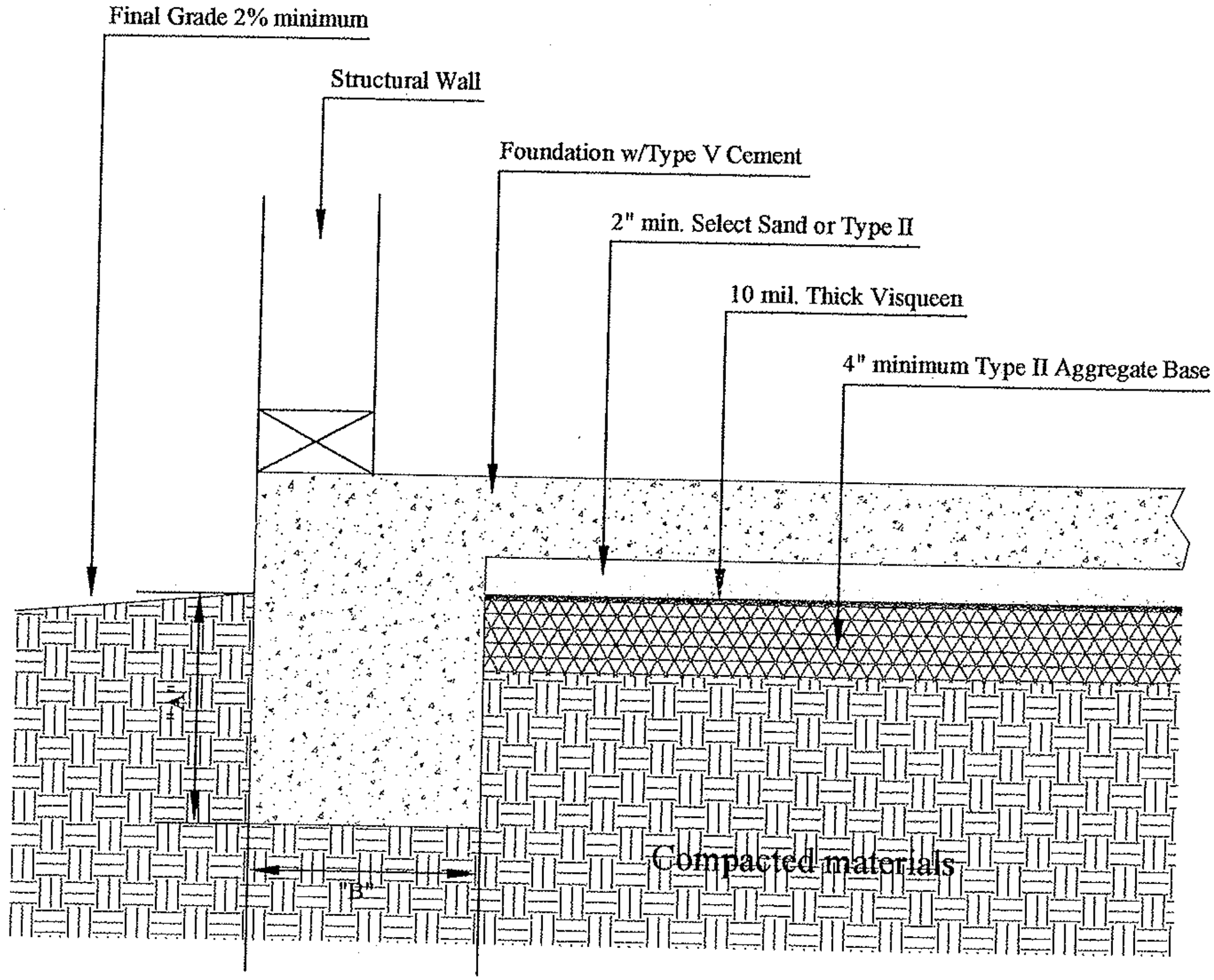
Figure No.: 2
NOT TO SCALE



American Soils Engineering, LLC
6000 S. Eastern Avenue, Suite 12E
Las Vegas, Nevada 89119
Phone: (702) 889-9617
Fax: (702) 889-9614
Geotechnical Engineering • Special Inspection • Materials Testing Services

TEST PIT LOCATION MAP	Project Number: PN 1060-GEO
Project: Phase I of Golden Valley Ranch Kingman - Arizona	Date: 09-09-2005
Prepared for: Rhodes Homes of Arizona	Drawn By: QB

Figure No.: 3
NOT TO SCALE



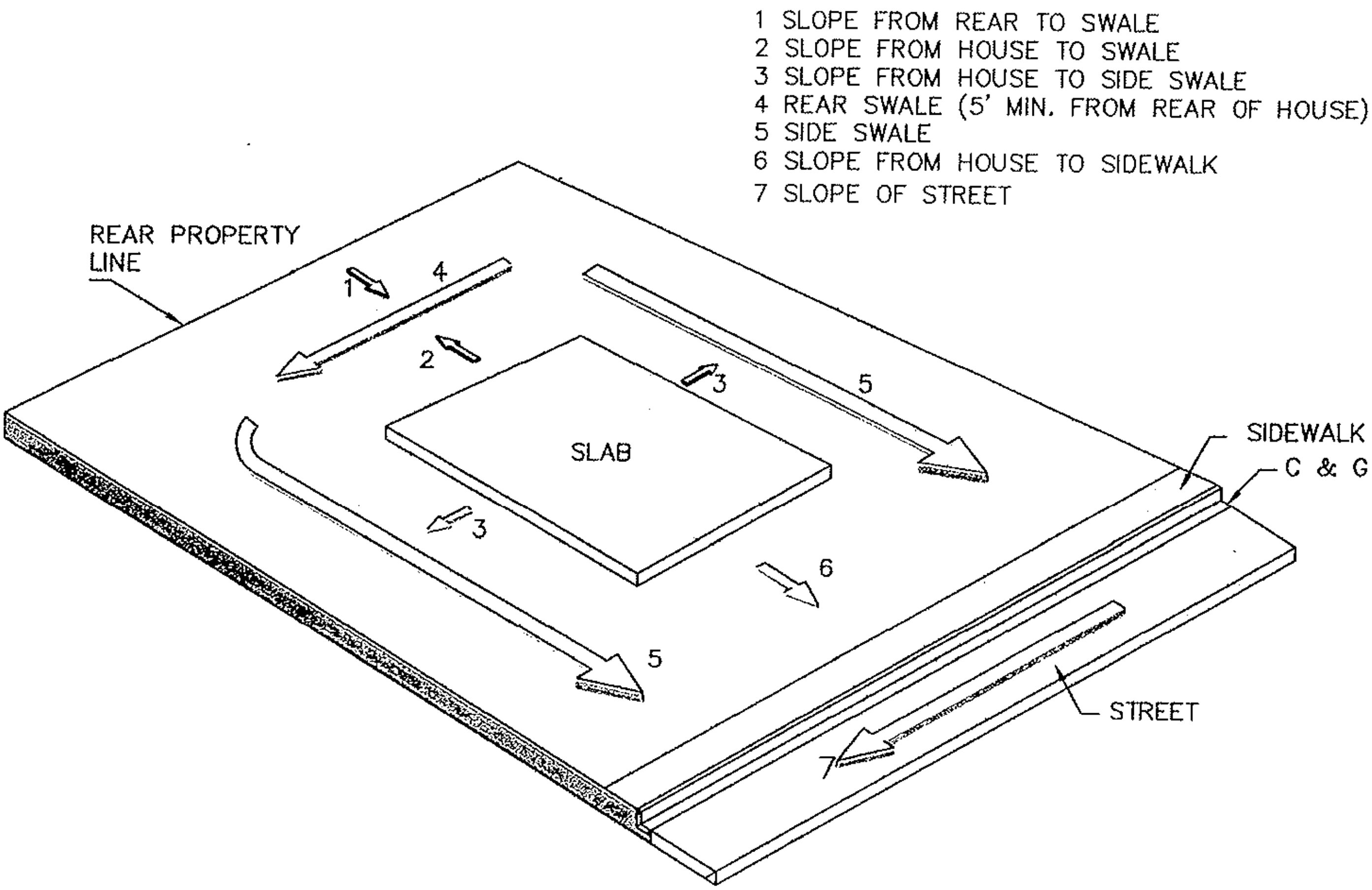
"A" — Depth of Footing (12" Low and 15" Moderately expansive condition)
"B" — Width of Footing (12" minimum)

LOW EXPANSIVE and MODERATELY EXPANSIVE TYPICAL FOUNDATION

Note: Concrete Foundation shown above as a "typical" detail only. Actual shape and dimensions to be designed by structural engineer and detailed in the project plans.

American Soils Engineering, LLC 6000 S. Eastern Avenue, Suite 12E Las Vegas, Nevada 89119 Phone: (702) 889-9617 Fax: (702) 889-9614 Geotechnical Engineering • Special Inspection • Materials Testing Services	FOUNDATION MAP	Project Number: PN 1060-GEO
	Project: Phase I of Golden Valley Ranch Kingman - Arizona	Date: 09-09-2005
	Prepared for: Rhodes Homes of Arizona	Drawn By: QB

Figure No.: 4
NOT TO SCALE



TYPICAL SURFACE DRAINAGE
NO SCALE

American Soils Engineering, LLC 6000 S. Eastern Avenue, Suite 12E Las Vegas, Nevada 89119 Phone: (702) 889-9617 Fax: (702) 889-9614 Geotechnical Engineering • Special Inspection • Materials Testing Services	SURFACE DRAINAGE MAP	Project Number: PN 1060-GEO
	Project: Phase I of Golden Valley Ranch Kingman - Arizona	Date: 09-09-2005
	Prepared for: Rhodes Homes of Arizona	Drawn By: QB

APPENDIX A

American Soils Engineering, LLC
6000 S. Eastern Avenue, Suite 12E
Las Vegas, NV 89119
Telephone: (702) 889-9617
Fax: (702) 88-9614

TEST PIT NUMBER TP-1

PAGE 1 OF 1

CLIENT Rhodes Homes of Arizona
PROJECT NAME Phase I at Golden Valley Ranch
PROJECT NUMBER PN 1060-GEO
PROJECT LOCATION Golden Valley, Kingman Ranch
DATE STARTED 7/20/05 COMPLETED 7/20/05
GROUND ELEVATION TEST PIT SIZE
EXCAVATION CONTRACTOR American Soils Engineering
GROUND WATER LEVELS:
EXCAVATION METHOD Backhoe
AT TIME OF EXCAVATION ---
LOGGED BY Q. Babul P.E. CHECKED BY Q. Babul P.E.
AT END OF EXCAVATION ---
NOTES
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Brown, Moist Silty sand with gravel, loose to medium dense
	BULK 1	2.0	
2.5			Brown, Silty sand with gravel, dense to very dense
5.0		5.0	Brown, Sandy gravel particially cemented, medium dense to dense
	BULK 2		
7.5			
10.0		10.0	excavation ends at 10'
12.5			
15.0			

Bottom of test pit at 15.0 feet.

GENERAL BH / TP / WELL WITHOUT TESTING REMARKS COLUMN PN 1060-GEO.GPJ AMERICAN SOILS.GDT 9/16/05

American Soils Engineering, LLC
6000 S. Eastern Avenue, Suite 12E
Las Vegas, NV 89119
Telephone: (702) 889-9617
Fax: (702) 88-9614

TEST PIT NUMBER TP-2

PAGE 1 OF 1

CLIENT Rhodes Homes of Arizona	PROJECT NAME Phase I at Golden Valley Ranch
PROJECT NUMBER PN 1060-GEO	PROJECT LOCATION Golden Valley, Kingman Ranch
DATE STARTED 7/20/05 COMPLETED 7/20/05	GROUND ELEVATION TEST PIT SIZE
EXCAVATION CONTRACTOR American Soils Engineering	GROUND WATER LEVELS:
EXCAVATION METHOD Backhoe	AT TIME OF EXCAVATION ---
LOGGED BY Q. Babul P.E. CHECKED BY Q. Babul P.E.	AT END OF EXCAVATION ---
NOTES	AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Brown, Dry Silty sandy gravel, loose to medium
2.5	BULK	2.0	Light Brown, Slightly moist sandy gravel with rocks medium to dense
5.0			
7.5			
10.0		10.0	excavation ends at 10'
12.5			
15.0			

Bottom of test pit at 15.0 feet.

GENERAL BH/TP/WELL WITHOUT TESTING REMARKS COLUMN PN 1060-GEO.GPJ AMERICAN SOILS.GDT 9/16/05

American Soils Engineering, LLC
6000 S. Eastern Avenue, Suite 12E
Las Vegas, NV 89119
Telephone: (702) 889-9617
Fax: (702) 88-9614

TEST PIT NUMBER TP-3

PAGE 1 OF 1

CLIENT Rhodes Homes of Arizona

PROJECT NAME Phase I at Golden Valley Ranch

PROJECT NUMBER PN 1060-GEO

PROJECT LOCATION Golden Valley, Kingman Ranch

DATE STARTED 7/20/05 COMPLETED 7/20/05

GROUND ELEVATION ______ TEST PIT SIZE ______

EXCAVATION CONTRACTOR American Soils Engineering

GROUND WATER LEVELS:

EXCAVATION METHOD Backhoe

AT TIME OF EXCAVATION ---

LOGGED BY Q. Babul P.E. CHECKED BY Q. Babul P.E.

AT END OF EXCAVATION ---

NOTES

AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Brown, moist silty sandy gravel, loose to medium dense
2.0			Light Brown, moist silty sandy gravel with cobbles and rocks, dense
2.5			
5.0	BULK 1		
7.5			
10.0			excavation ends at 10'
12.5			
15.0			

Bottom of test pit at 15.0 feet.

GENERAL P... WELL WITHOUT TESTING REMARKS COLUMN PN 1060-GEO.GPJ AMERICAN SOILS.GDT 9/16/05

American Soils Engineering, LLC
6000 S. Eastern Avenue, Suite 12E
Las Vegas, NV 89119
Telephone: (702) 889-9617
Fax: (702) 88-9614

TEST PIT NUMBER TP-4

PAGE 1 OF 1

CLIENT Rhodes Homes of Arizona

PROJECT NAME Phase I at Golden Valley Ranch

PROJECT NUMBER PN 1060-GEO

PROJECT LOCATION Golden Valley, Kingman Ranch

DATE STARTED 7/20/05 COMPLETED 7/20/05

GROUND ELEVATION ______ TEST PIT SIZE ______

EXCAVATION CONTRACTOR American Soils Engineering

GROUND WATER LEVELS:

EXCAVATION METHOD Backhoe

AT TIME OF EXCAVATION ---

LOGGED BY Q. Babul P.E. CHECKED BY Q. Babul P.E.

AT END OF EXCAVATION ---

NOTES

AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Light Brown, Dry silty sandy gravel, with cobbles, loose to medium dense
1.5	BULK 1		Brown, Slightly moist sandy gravel with rocks, medium, dense to dense
2.5			
5.0	BULK 2		
7.5			
10.0			excavation ends at 10'
12.5			
15.0			

Bottom of test pit at 15.0 feet.

GENERAL P[illegible]/WELL WITHOUT TESTING REMARKS COLUMN PN 1060-GEO.GPJ AMERICAN SOILS.GDT 9/16/05

American Soils Engineering, LLC
6000 S. Eastern Avenue, Suite 12E
Las Vegas, NV 89119
Telephone: (702) 889-9617
Fax: (702) 88-9614

TEST PIT NUMBER TP-5

PAGE 1 OF 1

CLIENT Rhodes Homes of Arizona	PROJECT NAME Phase I at Golden Valley Ranch
PROJECT NUMBER PN 1060-GEO	PROJECT LOCATION Golden Valley, Kingman Ranch
DATE STARTED 7/20/05 COMPLETED 7/20/05	GROUND ELEVATION TEST PIT SIZE
EXCAVATION CONTRACTOR American Soils Engineering	GROUND WATER LEVELS:
EXCAVATION METHOD Backhoe	AT TIME OF EXCAVATION ---
LOGGED BY Q. Babul P.E. CHECKED BY Q. Babul P.E.	AT END OF EXCAVATION ---
NOTES	AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Light Brown Slightly moist silty sandy gravel with some rocks loose to medium,dense
2.5		3.0	
	BULK 1		Brown Slightly moist silt sandy gravel, with cobbles and rock, medium to dense
5.0		7.0	
7.5	BULK 2		Slightly moist silty sandy gravel, particially cemented, very dense
10.0		10.0	excavation ends at 10'
12.5			
15.0			

Bottom of test pit at 15.0 feet.

GENERAL P[illegible]WELL WITHOUT TESTING REMARKS COLUMN PN 1060-GEO.GPJ AMERICAN SOILS.GDT 9/16/05

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6000 S. Eastern Avenue, Suite 12E
Las Vegas, NV 89119
Telephone: (702) 889-9617
Fax: (702) 88-9614

TEST PIT NUMBER TP-6

CLIENT Rhodes Homes of Arizona
PROJECT NAME Phase I at Golden Valley Ranch
PROJECT NUMBER PN 1060-GEO
PROJECT LOCATION Golden Valley, Kingman Ranch
DATE STARTED 7/20/05 **COMPLETED** 7/20/05
GROUND ELEVATION **TEST PIT SIZE**
EXCAVATION CONTRACTOR American Soils Engineering
GROUND WATER LEVELS:
EXCAVATION METHOD Backhoe
AT TIME OF EXCAVATION ---
LOGGED BY Q. Babul P.E. **CHECKED BY** Q. Babul P.E.
AT END OF EXCAVATION ---
NOTES
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Light Brown Slightly moist silty sandy gravel, with some rocks, loose to medium dense
	BULK 1		
2.5		4.0	
	BULK 2		Brown Slightly moist silty sandy gravel, with rocks, dense
5.0		7.0	
7.5			Light brown Slightly moist silty sandy gravel, particially cemented very dense
10.0		10.0	excavation ends at 10'
12.5			
15.0			

Bottom of test pit at 15.0 feet.

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TEST PIT NUMBER TP-7

PAGE 1 OF 1

CLIENT Rhodes Homes of Arizona

PROJECT NAME Phase I at Golden Valley Ranch

PROJECT NUMBER PN 1060-GEO

PROJECT LOCATION Golden Valley, Kingman Ranch

DATE STARTED 7/20/05 COMPLETED 7/20/05

GROUND ELEVATION TEST PIT SIZE

EXCAVATION CONTRACTOR American Soils Engineering

GROUND WATER LEVELS:

EXCAVATION METHOD Backhoe

AT TIME OF EXCAVATION ---

LOGGED BY Q. Babul P.E. CHECKED BY Q. Babul P.E.

AT END OF EXCAVATION ---

NOTES

AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Light Brown Slightly moist silty sandy gravel, medium dense
2.0			Brown Slightly moist silty sandy gravel, with rocks, boulders, dense to very dense
2.5	BULK 1		
5.0			
	BULK 2		
7.5			
10.0			excavation ends at 10'
12.5			
15.0			

Bottom of test pit at 15.0 feet.

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Las Vegas, NV 89119
Telephone: (702) 889-9617
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TEST PIT NUMBER TP-8

PAGE 1 OF 1

CLIENT Rhodes Homes of Arizona
PROJECT NAME Phase I at Golden Valley Ranch
PROJECT NUMBER PN 1060-GEO
PROJECT LOCATION Golden Valley, Kingman Ranch
DATE STARTED 7/20/05 COMPLETED 7/20/05
GROUND ELEVATION TEST PIT SIZE
EXCAVATION CONTRACTOR American Soils Engineering
GROUND WATER LEVELS:
EXCAVATION METHOD Backhoe
AT TIME OF EXCAVATION ---
LOGGED BY Q. Babul P.E. CHECKED BY Q. Babul P.E.
AT END OF EXCAVATION ---
NOTES
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Light brown Slightly moist silty sandy gravel
	BULK 1	1.0	Light brown Silty sandy with gravel and rocks, medium dense to dense
2.5			
5.0	BULK 2	5.0	Light brown Silty sandy with gravel - encountered boulder, very dense
7.5			
10.0		10.0	excavation ends at 10'
12.5			
15.0			

Bottom of test pit at 15.0 feet.

GENERAL BH / TP / WELL WITHOUT TESTING REMARKS COLUMN PN 1060-GEO.GPJ AMERICAN SOILS.GDT 9/16/05

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TEST PIT NUMBER TP-9

PAGE 1 OF 1

CLIENT Rhodes Homes of Arizona

PROJECT NAME Phase I at Golden Valley Ranch

PROJECT NUMBER PN 1060-GEO

PROJECT LOCATION Golden Valley, Kingman Ranch

DATE STARTED 7/21/05 **COMPLETED** 7/21/05

GROUND ELEVATION **TEST PIT SIZE**

EXCAVATION CONTRACTOR American Soils Engineering

GROUND WATER LEVELS:

EXCAVATION METHOD Backhoe

AT TIME OF EXCAVATION ---

LOGGED BY Q. Babul P.E. **CHECKED BY** Q. Babul P.E.

AT END OF EXCAVATION ---

NOTES

AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Light brown Slightly moist silty sandy gravel/boulders, medium dense to dense
2.0	BULK		Brown Slighlty moist took sample silty sandy gravel with boulders, dense to very dense
10.0			excavation ends at 10'

Depth scale: 0.0, 2.5, 5.0, 7.5, 10.0, 12.5, 15.0

Bottom of test pit at 15.0 feet.

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Las Vegas, NV 89119
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TEST PIT NUMBER TP-10

PAGE 1 OF 1

CLIENT Rhodes Homes of Arizona
PROJECT NAME Phase I at Golden Valley Ranch
PROJECT NUMBER PN 1060-GEO
PROJECT LOCATION Golden Valley, Kingman Ranch
DATE STARTED 7/21/05 **COMPLETED** 7/21/05
GROUND ELEVATION **TEST PIT SIZE**
EXCAVATION CONTRACTOR American Soils Engineering
GROUND WATER LEVELS:
EXCAVATION METHOD Backhoe
AT TIME OF EXCAVATION ---
LOGGED BY Q. Babul P.E. **CHECKED BY** Q. Babul P.E.
AT END OF EXCAVATION ---
NOTES
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Light Brown, Slightly moist silty sandy with gravel, medium dense
2.0			Brown, Slighlty moist silty sandy with rock boulder, medium dense to dense
2.5			
	BULK		
5.0			
7.5			
10.0			excavation ends at 10'
12.5			
15.0			

Bottom of test pit at 15.0 feet.

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Las Vegas, NV 89119
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Fax: (702) 88-9614

TEST PIT NUMBER TP-11

PAGE 1 OF 1

CLIENT	Rhodes Homes of Arizona	PROJECT NAME	Phase I at Golden Valley Ranch
PROJECT NUMBER	PN 1060-GEO	PROJECT LOCATION	Golden Valley, Kingman Ranch
DATE STARTED	7/21/05 COMPLETED 7/21/05	GROUND ELEVATION	TEST PIT SIZE
EXCAVATION CONTRACTOR	American Soils Engineering	GROUND WATER LEVELS:	
EXCAVATION METHOD	Backhoe	AT TIME OF EXCAVATION	---
LOGGED BY	Q. Babul P.E. CHECKED BY Q. Babul P.E.	AT END OF EXCAVATION	---
NOTES		AFTER EXCAVATION	---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Light Brown, Slightly moist silty with gravel, loose to medium dense
2.5			
3.0			Brown, Slighlty moist silty sand with gravel, medium to dense
5.0	BULK		
7.5			
10.0			excavation ends at 10'
12.5			
15.0			

Bottom of test pit at 15.0 feet.

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Las Vegas, NV 89119
Telephone: (702) 889-9617
Fax: (702) 88-9614

TEST PIT NUMBER TP-12

PAGE 1 OF 1

CLIENT Rhodes Homes of Arizona

PROJECT NAME Phase I at Golden Valley Ranch

PROJECT NUMBER PN 1060-GEO

PROJECT LOCATION Golden Valley, Kingman Ranch

DATE STARTED 7/21/05 COMPLETED 7/21/05

GROUND ELEVATION ______ TEST PIT SIZE ______

EXCAVATION CONTRACTOR American Soils Engineering

GROUND WATER LEVELS:

EXCAVATION METHOD Backhoe

AT TIME OF EXCAVATION ---

LOGGED BY Q. Babul P.E. CHECKED BY Q. Babul P.E.

AT END OF EXCAVATION ---

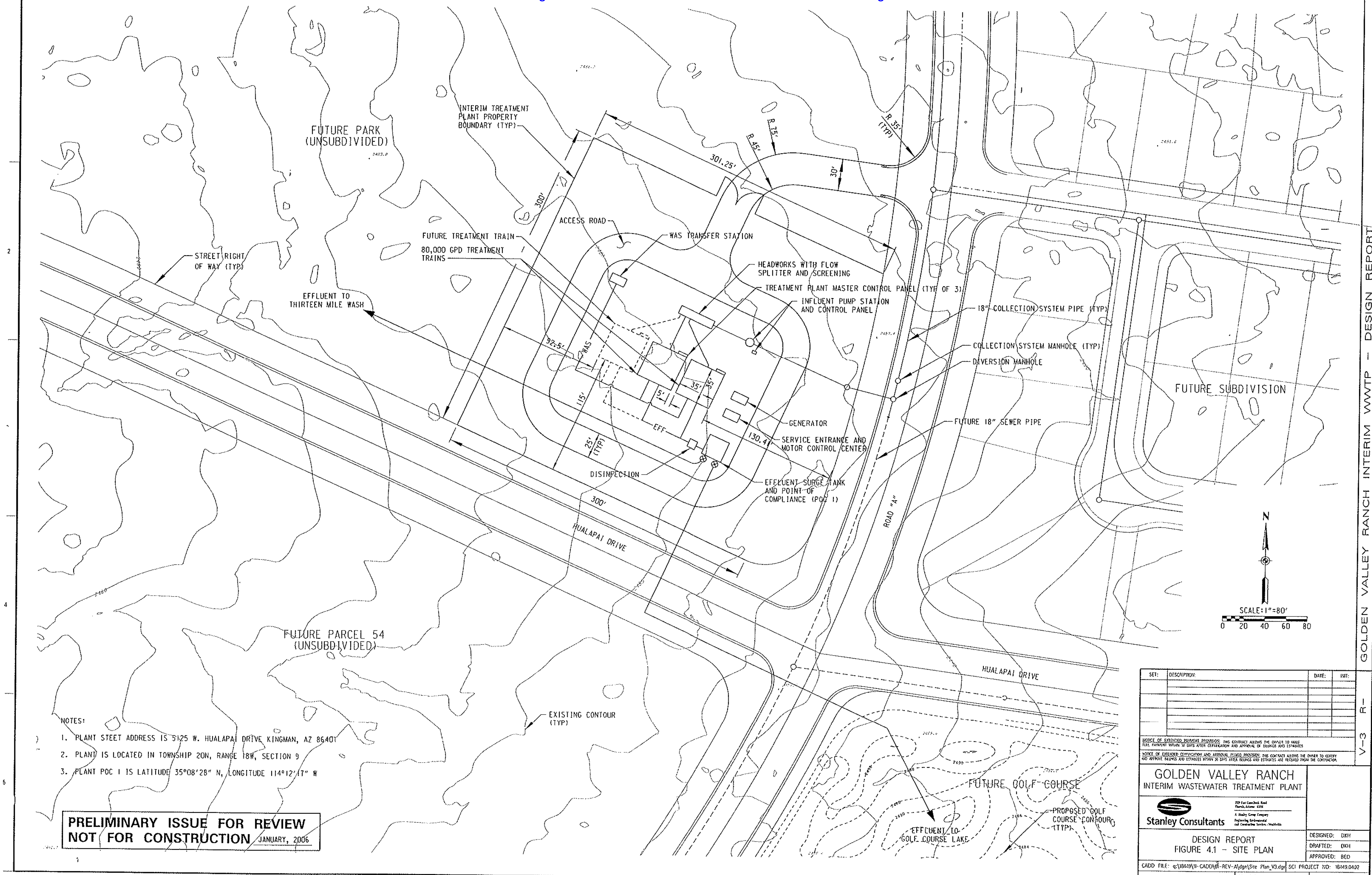
NOTES

AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Brown, Slighlty moist silty sand with gravel, loose to medium dense
	BULK 1	2.0	
2.5			Light Brown, Moist silty sand with gravel, medium to dense
5.0	BULK 2		
7.5			
10.0		10.0	excavation ends at 10'
12.5			
15.0			

Bottom of test pit at 15.0 feet.

GENERAL BH / TP / WELL WITHOUT TESTING REMARKS COLUMN PN 1060-GEO.GPJ AMERICAN SOILS.GDT 9/16/05


FUTURE PARK
(UNSUBDIVIDED)
INTERIM TREATMENT PLANT PROPERTY BOUNDARY (TYP)
R 75'
R 45'
R 35' (TYP)
301.25'
300'
30'
ACCESS ROAD
FUTURE TREATMENT TRAIN
80,000 GPD TREATMENT TRAINS
WAS TRANSFER STATION
HEADWORKS WITH FLOW SPLITTER AND SCREENING
TREATMENT PLANT MASTER CONTROL PANEL (TYP OF 3)
INFLUENT PUMP STATION AND CONTROL PANEL
18" COLLECTION SYSTEM PIPE (TYP)
COLLECTION SYSTEM MANHOLE (TYP)
DIVERSION MANHOLE
STREET RIGHT OF WAY (TYP)
EFFLUENT TO THIRTEEN MILE WASH
92.5'
WAS
115'
35'
5'
EFF
25' (TYP)
130.4'
GENERATOR
SERVICE ENTRANCE AND MOTOR CONTROL CENTER
FUTURE 18" SEWER PIPE
DISINFECTION
EFFLUENT SURGE TANK AND POINT OF COMPLIANCE (POC 1)
300'
HUALAPAI DRIVE
ROAD "A"
FUTURE SUBDIVISION
N
SCALE: 1"=80'
0 20 40 60 80
FUTURE PARCEL 54
(UNSUBDIVIDED)
HUALAPAI DRIVE
EXISTING CONTOUR (TYP)
FUTURE GOLF COURSE
PROPOSED GOLF COURSE CONTOUR (TYP)
EFFLUENT TO GOLF COURSE LAKE
NOTES:
1. PLANT STREET ADDRESS IS 5125 W. HUALAPAI DRIVE KINGMAN, AZ 86401
2. PLANT IS LOCATED IN TOWNSHIP 20N, RANGE 18W, SECTION 9
3. PLANT POC 1 IS LATITUDE 35°08'28" N, LONGITUDE 114°12'17" W
PRELIMINARY ISSUE FOR REVIEW
NOT FOR CONSTRUCTION
JANUARY, 2006
GOLDEN VALLEY RANCH INTERIM WWTP - DESIGN REPORT
SET: DESCRIPTION: DATE: INIT:
GOLDEN VALLEY RANCH
INTERIM WASTEWATER TREATMENT PLANT
Stanley Consultants
DESIGN REPORT
FIGURE 4.1 - SITE PLAN
DESIGNED: DKH
DRAFTED: DKH
APPROVED: BED
SCI PROJECT NO: 18449.04.02
PRINT DATE: 1/17/2006
SHEET: 1 OF
V-3
R-

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6000 S. Eastern Avenue, Suite 12E
Las Vegas, NV 89119
Telephone: (702) 889-9617
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TEST PIT NUMBER TP-13

PAGE 1 OF 1

CLIENT	Rhodes Homes of Arizona	PROJECT NAME	Phase I at Golden Valley Ranch
PROJECT NUMBER	PN 1060-GEO	PROJECT LOCATION	Golden Valley, Kingman Ranch
DATE STARTED	7/21/05 COMPLETED 7/21/05	GROUND ELEVATION	TEST PIT SIZE
EXCAVATION CONTRACTOR	American Soils Engineering	GROUND WATER LEVELS:	
EXCAVATION METHOD	Backhoe	AT TIME OF EXCAVATION	---
LOGGED BY	Q. Babul P.E. CHECKED BY Q. Babul P.E.	AT END OF EXCAVATION	---
NOTES		AFTER EXCAVATION	---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Light Brown, slightly moist silty sandy with gravel, loose to medium dense
2.5	BULK		
3.0			Brown, Slightly moist silty sandy gravel with boulders, medium dense to dense
5.0			
7.5			
10.0			excavation ends at 10'
12.5			
15.0			

Bottom of test pit at 15.0 feet.

GENERAL B... WELL WITHOUT TESTING REMARKS COLUMN PN 1060-GEO.GPJ AMERICAN SOILS.GDT 9/16/05

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TEST PIT NUMBER TP-14

PAGE 1 OF 1

CLIENT Rhodes Homes of Arizona

PROJECT NAME Phase I at Golden Valley Ranch

PROJECT NUMBER PN 1060-GEO

PROJECT LOCATION Golden Valley, Kingman Ranch

DATE STARTED 7/21/05 COMPLETED 7/21/05

GROUND ELEVATION ______ TEST PIT SIZE ______

EXCAVATION CONTRACTOR American Soils Engineering

GROUND WATER LEVELS:

EXCAVATION METHOD Backhoe

AT TIME OF EXCAVATION ---

LOGGED BY Q. Babul P.E. CHECKED BY Q. Babul P.E.

AT END OF EXCAVATION ---

NOTES

AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Light Brown, Slightly moist silty sandy with gravel, loose to medium dense
2.5	BULK 1		
		4.0	Brown, Slightly moist sandy gravel, medium to dense
5.0			
7.5	BULK 2		
10.0		10.0	excavation ends at 10'
12.5			
15.0			

Bottom of test pit at 15.0 feet.

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Las Vegas, NV 89119
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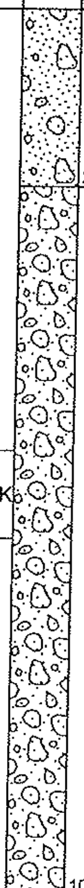
TEST PIT NUMBER TP-15

PAGE 1 OF 1

CLIENT Rhodes Homes of Arizona
PROJECT NAME Phase I at Golden Valley Ranch
PROJECT NUMBER PN 1060-GEO
PROJECT LOCATION Golden Valley, Kingman Ranch
DATE STARTED 7/21/05 COMPLETED 7/21/05
GROUND ELEVATION TEST PIT SIZE
EXCAVATION CONTRACTOR American Soils Engineering
GROUND WATER LEVELS:
EXCAVATION METHOD Backhoe
AT TIME OF EXCAVATION ---
LOGGED BY Q. Babul P.E. CHECKED BY Q. Babul P.E.
AT END OF EXCAVATION ---
NOTES
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Brown, Slightly moist Silty sandy with gravel, loose to medium dense
2.0			Brown, Moist gravelly sand, with cobbles and rocks dense
5.0	BULK		
10.0			excavation ends at 10'
15.0			



Bottom of test pit at 15.0 feet.

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TEST PIT NUMBER TP-16

PAGE 1 OF 1

CLIENT Rhodes Homes of Arizona
PROJECT NAME Phase I at Golden Valley Ranch
PROJECT NUMBER PN 1060-GEO
PROJECT LOCATION Golden Valley, Kingman Ranch
DATE STARTED 7/21/05 COMPLETED 7/21/05
GROUND ELEVATION TEST PIT SIZE
EXCAVATION CONTRACTOR American Soils Engineering
GROUND WATER LEVELS:
EXCAVATION METHOD Backhoe
AT TIME OF EXCAVATION ---
LOGGED BY Q. Babul P.E. CHECKED BY Q. Babul P.E.
AT END OF EXCAVATION ---
NOTES
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Light Brown, Slightly moist silty sandy gravel, loose to medium dense
2.5	BULK 1		
		4.0	Brown, Gravelly sand could not take test density test, dense
5.0	BULK 2		
7.5			
10.0		10.0	excavation ends at 10'
12.5			
15.0			

Bottom of test pit at 15.0 feet.

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TEST PIT NUMBER TP-17

PAGE 1 OF 1

CLIENT Rhodes Homes of Arizona
PROJECT NAME Phase I at Golden Valley Ranch
PROJECT NUMBER PN 1060-GEO
PROJECT LOCATION Golden Valley, Kingman Ranch
DATE STARTED 7/21/05 COMPLETED 7/21/05
GROUND ELEVATION TEST PIT SIZE
EXCAVATION CONTRACTOR American Soils Engineering
GROUND WATER LEVELS:
EXCAVATION METHOD Backhoe
AT TIME OF EXCAVATION ---
LOGGED BY Q. Babul P.E. CHECKED BY Q. Babul P.E.
AT END OF EXCAVATION ---
NOTES
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Light Brown, Slighlty moist silty sandy with gravel, loose to medium dense
2.0			Brown, Slighlty moist sandy gravel with rocks, medium to dense
2.5	BULK		
5.0			
7.5			
10.0			excation ends at 10'
12.5			
15.0			

Bottom of test pit at 15.0 feet.

GENERAL BH / TP / WELL WITHOUT TESTING REMARKS COLUMN PN 1060-GEO.GPJ AMERICAN SOILS.GDT 9/16/05

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TEST PIT NUMBER TP-18

PAGE 1 OF 1

CLIENT Rhodes Homes of Arizona
PROJECT NAME Phase I at Golden Valley Ranch
PROJECT NUMBER PN 1060-GEO
PROJECT LOCATION Golden Valley, Kingman Ranch
DATE STARTED 7/21/05 COMPLETED 7/21/05
GROUND ELEVATION TEST PIT SIZE
EXCAVATION CONTRACTOR American Soils Engineering
GROUND WATER LEVELS:
EXCAVATION METHOD Backhoe
AT TIME OF EXCAVATION ---
LOGGED BY Q. Babul P.E. CHECKED BY Q. Babul P.E.
AT END OF EXCAVATION ---
NOTES
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Light Brown, Dry silty sandy gravel, loose to medium dense
2.5		3.0	Brown, Slighlty moist silty sandy gravel, with rock and cobbles, dense
5.0	BULK		
7.5		7.0	Light Brown, Slighlty moist sandy gravel, particially cemented, very dense
10.0		10.0	excavation ends at 10'
12.5			
15.0			

Bottom of test pit at 15.0 feet.

GENERAL BH / TP / WELL WITHOUT TESTING REMARKS COLUMN PN 1060-GEO.GPJ AMERICAN SOILS.GDT 9/16/05

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Telephone: (702) 889-9617
Fax: (702) 88-9614

TEST PIT NUMBER TP-19

PAGE 1 OF 1

CLIENT Rhodes Homes of Arizona	PROJECT NAME Phase I at Golden Valley Ranch
PROJECT NUMBER PN 1060-GEO	PROJECT LOCATION Golden Valley, Kingman Ranch
DATE STARTED 7/22/05 COMPLETED 7/22/05	GROUND ELEVATION TEST PIT SIZE
EXCAVATION CONTRACTOR American Soils Engineering	GROUND WATER LEVELS:
EXCAVATION METHOD Backhoe	AT TIME OF EXCAVATION ---
LOGGED BY Q. Babul P.E. CHECKED BY Q. Babul P.E.	AT END OF EXCAVATION ---
NOTES	AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Brown, Dry silty sandy gravel, loose to medium dense
		1.0	Brown, Slighlty moist silty sandy gravel with rocks dense
2.5			
	BULK		
5.0		5.0	Light Brown, Slightly moist silty sandy gravel with boulders, particially cemented, very dense
7.5			
10.0		10.0	excavation ends at 10'
12.5			
15.0			

Bottom of test pit at 15.0 feet.

GENERAL BH/TP/WELL WITHOUT TESTING REMARKS COLUMN PN 1060-GEO.GPJ AMERICAN SOILS.GDT 9/16/05

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Las Vegas, NV 89119
Telephone: (702) 889-9617
Fax: (702) 88-9614

TEST PIT NUMBER TP-20

PAGE 1 OF 1

CLIENT Rhodes Homes of Arizona
PROJECT NAME Phase I at Golden Valley Ranch
PROJECT NUMBER PN 1060-GEO
PROJECT LOCATION Golden Valley, Kingman Ranch
DATE STARTED 7/22/05 COMPLETED 7/22/05
GROUND ELEVATION TEST PIT SIZE
EXCAVATION CONTRACTOR American Soils Engineering
GROUND WATER LEVELS:
EXCAVATION METHOD Backhoe
AT TIME OF EXCAVATION ---
LOGGED BY Q. Babul P.E. CHECKED BY Q. Babul P.E.
AT END OF EXCAVATION ---
NOTES
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Light Brown, Slightly moist silty sandy gravel, medium dense
2.5	BULK		
		3.0	Brown, Slightly moist silty sandy gravel with boulders, dense
5.0			
7.5			
10.0		10.0	excavation ends at 10'
12.5			
15.0			

Bottom of test pit at 15.0 feet.

GENERAL BH / TP / WELL WITHOUT TESTING REMARKS COLUMN PN 1060-GEO.GPJ AMERICAN SOILS.GDT 9/16/05

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TEST PIT NUMBER TP-21

PAGE 1 OF 1

CLIENT Rhodes Homes of Arizona	PROJECT NAME Phase I at Golden Valley Ranch
PROJECT NUMBER PN 1060-GEO	PROJECT LOCATION Golden Valley, Kingman Ranch
DATE STARTED 7/22/05 COMPLETED 7/22/05	GROUND ELEVATION TEST PIT SIZE
EXCAVATION CONTRACTOR American Soils Engineering	GROUND WATER LEVELS:
EXCAVATION METHOD Backhoe	AT TIME OF EXCAVATION ---
LOGGED BY Q. Babul P.E. CHECKED BY Q. Babul P.E.	AT END OF EXCAVATION ---
NOTES	AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Light Brown, Dry, fine silty sandy gravel, loose to medium dense
2.5	BULK		
		4.0	Brown, Slightly mosit sandy gravel with cobbles and rocks medium to dense
5.0			
7.5			
10.0		10.0	excavation ends at 10'
12.5			
15.0			

Bottom of test pit at 15.0 feet.

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Las Vegas, NV 89119
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TEST PIT NUMBER TP-22

PAGE 1 OF 1

CLIENT Rhodes Homes of Arizona
PROJECT NAME Phase I at Golden Valley Ranch
PROJECT NUMBER PN 1060-GEO
PROJECT LOCATION Golden Valley, Kingman Ranch
DATE STARTED 7/22/05 COMPLETED 7/22/05
GROUND ELEVATION TEST PIT SIZE
EXCAVATION CONTRACTOR American Soils Engineering
GROUND WATER LEVELS:
EXCAVATION METHOD Backhoe
AT TIME OF EXCAVATION ---
LOGGED BY Q. Babul P.E. CHECKED BY Q. Babul P.E.
AT END OF EXCAVATION ---
NOTES
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Light Brown, Slighty moist silty sandy gravel, with cobbles, loose to medium dense
2.5	BULK		
5.0		5.0	Brown, particially cemented, silty sandy gravel, dense
7.5		8.0	Light Brown, Particially cemented silty sandy gravel, very dense
10.0		10.0	excavation ends at 10'
12.5			
15.0			

Bottom of test pit at 15.0 feet.

GENERAL BH/TP/WELL WITHOUT TESTING REMARKS COLUMN PN 1060-GEO.GPJ AMERICAN SOILS.GDT 9/16/05

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6000 S. Eastern Avenue, Suite 12E
Las Vegas, NV 89119
Telephone: (702) 889-9617
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TEST PIT NUMBER TP-23

PAGE 1 OF 1

CLIENT Rhodes Homes of Arizona

PROJECT NAME Phase I at Golden Valley Ranch

PROJECT NUMBER PN 1060-GEO

PROJECT LOCATION Golden Valley, Kingman Ranch

DATE STARTED 7/22/05 COMPLETED 7/22/05

GROUND ELEVATION ______ TEST PIT SIZE ______

EXCAVATION CONTRACTOR American Soils Engineering

GROUND WATER LEVELS:

EXCAVATION METHOD Backhoe

AT TIME OF EXCAVATION ---

LOGGED BY Q. Babul P.E. CHECKED BY Q. Babul P.E.

AT END OF EXCAVATION ---

NOTES

AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Brown, Slightly moist silty sandy gravel, loose to medium dense
2.0			Brown, Slightly most silty sandy gravel
2.5	BULK		
10.0			excavation ends at 10'
15.0			

Bottom of test pit at 15.0 feet.

GENERAL BH / TP / WELL WITHOUT TESTING REMARKS COLUMN PN 1060-GEO.GPJ AMERICAN SOILS.GDT 9/16/05

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Las Vegas, NV 89119
Telephone: (702) 889-9617
Fax: (702) 88-9614

TEST PIT NUMBER TP-24

CLIENT	Rhodes Homes of Arizona	PROJECT NAME	Phase I at Golden Valley Ranch
PROJECT NUMBER	PN 1060-GEO	PROJECT LOCATION	Golden Valley, Kingman Ranch
DATE STARTED	7/21/05 COMPLETED 7/21/05	GROUND ELEVATION	TEST PIT SIZE
EXCAVATION CONTRACTOR	American Soils Engineering	GROUND WATER LEVELS:	
EXCAVATION METHOD	Backhoe	AT TIME OF EXCAVATION	---
LOGGED BY	Q. Babul P.E. CHECKED BY Q. Babul P.E.	AT END OF EXCAVATION	---
NOTES		AFTER EXCAVATION	---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Light Brown, Slighlty moist silty sandy gravel, loose to medium dense
2.5			
		3.0	Brown, Slighlty moist silty sandy gravel, with rocks, medium to dense
5.0	BULK		
7.5			
10.0		10.0	excavation ends at 10'
12.5			
15.0			

Bottom of test pit at 15.0 feet.

GENERAL BH/WELL WITHOUT TESTING REMARKS COLUMN PN 1060-GEO.GPJ AMERICAN SOILS.GDT 9/16/05

American Soils Engineering, LLC
6000 S. Eastern Avenue, Suite 12E
Las Vegas, NV 89119
Telephone: (702) 889-9617
Fax: (702) 88-9614

TEST PIT NUMBER TP-25

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CLIENT	Rhodes Homes of Arizona	PROJECT NAME	Phase I at Golden Valley Ranch
PROJECT NUMBER	PN 1060-GEO	PROJECT LOCATION	Golden Valley, Kingman Ranch
DATE STARTED	7/22/05 COMPLETED 7/22/05	GROUND ELEVATION	TEST PIT SIZE
EXCAVATION CONTRACTOR	American Soils Engineering	GROUND WATER LEVELS:	
EXCAVATION METHOD	Backhoe	AT TIME OF EXCAVATION	---
LOGGED BY	Q. Babul P.E. CHECKED BY Q. Babul P.E.	AT END OF EXCAVATION	---
NOTES		AFTER EXCAVATION	---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Light Brown, Slightly moist silty clay with gravel with boulders, medium dense
2.0			Light Brown, Slightly moist silty sandy gravel with cobble and rocks, medium to dense
2.5	BULK		
5.0			
7.5			
10.0			excavation ends at 10'
12.5			
15.0			

Bottom of test pit at 15.0 feet.

GENERAL BH / TP / WELL WITHOUT TESTING REMARKS COLUMN PN 1060-GEO.GPJ AMERICAN SOILS.GDT 9/16/05

American Soils Engineering, LLC
6000 S. Eastern Avenue, Suite 12E
Las Vegas, NV 89119
Telephone: (702) 889-9617
Fax: (702) 88-9614

TEST PIT NUMBER TP-26

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CLIENT Rhodes Homes of Arizona

PROJECT NAME Phase I at Golden Valley Ranch

PROJECT NUMBER PN 1060-GEO

PROJECT LOCATION Golden Valley, Kingman Ranch

DATE STARTED 7/22/05 COMPLETED 7/22/05

GROUND ELEVATION ______ TEST PIT SIZE ______

EXCAVATION CONTRACTOR American Soils Engineering

GROUND WATER LEVELS:

EXCAVATION METHOD Backhoe

AT TIME OF EXCAVATION —

LOGGED BY Q. Babul P.E. CHECKED BY Q. Babul P.E.

AT END OF EXCAVATION —

NOTES

AFTER EXCAVATION —

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Light Brown, Slighly moist silty clay with gravel, loose to medium dense
2.0			Brown, Slighlty moist silty sandy gravel, with rocks medium to dense
5.0	BULK		
7.0			Light Brown, Slighlty moist silty sandy gravel partcially cemented, very dense
10.0			excavation ends at 10'
15.0			

Bottom of test pit at 15.0 feet.

American Soils Engineering, LLC
6000 S. Eastern Avenue, Suite 12E
Las Vegas, NV 89119
Telephone: (702) 889-9617
Fax: (702) 88-9614

TEST PIT NUMBER TP-27

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CLIENT Rhodes Homes of Arizona

PROJECT NAME Phase I at Golden Valley Ranch

PROJECT NUMBER PN 1060-GEO

PROJECT LOCATION Golden Valley, Kingman Ranch

DATE STARTED 7/22/05 COMPLETED 7/22/05

GROUND ELEVATION TEST PIT SIZE

EXCAVATION CONTRACTOR American Soils Engineering

GROUND WATER LEVELS:

EXCAVATION METHOD Backhoe

AT TIME OF EXCAVATION ---

LOGGED BY Q. Babul P.E. CHECKED BY Q. Babul P.E.

AT END OF EXCAVATION ---

NOTES

AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Light Brown, Slighlty moist silty clay with gravel, loose to medium dense
2.5		3.0	
	BULK		Brown, Slighlty moist silty clay with gravel with cobbles and rocks medium to dense
5.0		6.0	
			Light Brown, Slighlty moist silty clay with gravel, particially cemented, very dense
7.5			
10.0		10.0	excavation ends at 10'
12.5			
15.0			

Bottom of test pit at 15.0 feet.

GENERAL P VELL WITHOUT TESTING REMARKS COLUMN PN 1060-GEO.GPJ AMERICAN SOILS.GDT 9/16/05

American Soils Engineering, LLC
6000 S. Eastern Avenue, Suite 12E
Las Vegas, NV 89119
Telephone: (702) 889-9617
Fax: (702) 88-9614

TEST PIT NUMBER TP-28

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CLIENT Rhodes Homes of Arizona

PROJECT NAME Phase I at Golden Valley Ranch

PROJECT NUMBER PN 1060-GEO

PROJECT LOCATION Golden Valley, Kingman Ranch

DATE STARTED 7/22/05 COMPLETED 7/22/05

GROUND ELEVATION ______ TEST PIT SIZE ______

EXCAVATION CONTRACTOR American Soils Engineering

GROUND WATER LEVELS:

EXCAVATION METHOD Backhoe

AT TIME OF EXCAVATION —

LOGGED BY Q. Babul P.E. CHECKED BY Q. Babul P.E.

AT END OF EXCAVATION —

NOTES

AFTER EXCAVATION —

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Brown, Slighlty moist silty clay with gravel, loose
1.0			Brown, Slighlty moist sandy clay with gravel, with rocks medium to dense
2.5			
5.0	BULK		
7.5			
10.0			excavation ends at 10'
12.5			
15.0			

Bottom of test pit at 15.0 feet.

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6000 S. Eastern Avenue, Suite 12E
Las Vegas, NV 89119
Telephone: (702) 889-9617
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TEST PIT NUMBER TP-29

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CLIENT Rhodes Homes of Arizona
PROJECT NAME Phase I at Golden Valley Ranch
PROJECT NUMBER PN 1060-GEO
PROJECT LOCATION Golden Valley, Kingman Ranch
DATE STARTED 7/22/05 COMPLETED 7/22/05
GROUND ELEVATION ______ TEST PIT SIZE ______
EXCAVATION CONTRACTOR American Soils Engineering
GROUND WATER LEVELS:
EXCAVATION METHOD Backhoe
AT TIME OF EXCAVATION ---
LOGGED BY Q. Babul P.E. CHECKED BY Q. Babul P.E.
AT END OF EXCAVATION ---
NOTES
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			Light Brown, Slightly moist silty clay with gravel, loose to medium dense
3.0	BULK		Brown, Slightly moist silty sandy gravel with rocks, medium dense
10.0			excavation ends at 10'
15.0			

Bottom of test pit at 15.0 feet.